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FACTORS IN PUPIL SUCCESS AT THE HIGHER SECONDARY STAGE

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S. Baqer Mehdi, M.A., Ph.D. (Alig.)
Reader, Dept. of Psychology
Aligarh Muslim University
Aligarh, U.P.

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To

My Uncle

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PREFACE

The school authorities have long been concerned with the problem of allocating pupils to secondary school courses suited to their abilities, aptitudes. interests and personality qualities.

With the rapidly growing school population the range of individual differences in such important respects as abilities, aptitudes, interests and personality characteristics has tended to increase and it has become necessary both for effective teaching in schools and proper utilisation of human resources that, at a certain stage in their educational career, pupils are provided a type of guidance which would enable them to choose courses appropriate to their level and direction of mental functioning. *This is likely to result in a reasonably higher level of achievement on their part.*

An important question in this connection is that of the stage at which diversification should take place. This question is naturally linked up with the question of age at which individual differences in abilities, aptitudes and interests get sufficiently marked to warrant diversification of courses. Researches have shown that the age for diversification will vary according to whether diverse types of opportunities for the realization of talents and development of interests have or have not been provided to children in the formative years of their life, that is, the early years extending to the primary school stage. The more restricted and the more uniform the environment during the early period of growth the less chances there are for differentiation to take place till late in their lives. On the other hand, if a rich and varied environment has been provided to children right through the early stages of growth, the chances are that differentiation of abilities and interests will take place rather early in life, say, between ages 11 and 14. It is a well known fact that abilities and interests do not develop in a vacuum. They require a rich and varied environment for their proper growth and development. In India where for the majority of children the social-cultural and educational environment is anything but rich and varied, it is futile to look for differences that would warrant a rigid differentiation even as late as 15 or 16. The scheme of multipurpose schools suggested by the Mudaliar Commission (1953) in which diversification was recommended at the end of class VIII corresponding to the age of 13-14, though failed to gain favour in the states on other grounds could not have made a success even from a purely educational point of view as the results of the present study suggest. The recommendations of the Kothari Commission (1963) to postpone diversification of courses till theend of High School, that is, the age of 15 plus is more in accord with the socio-economic conditions obtaining in the country and the educational opportunitics available at the earlier stages of life. The results of the present study clearly indicate that as pupils pass through the secondary stage and reach the end of class XI the differences become more clearly marked, most probably as a result of differential stimulation during the period of three years at the Higher Secondary stage, though here too the disadvantages of early deprivation seem to persist,

The present study besides pointing to this important fact also shows very clearly that the notion commonly held by counsellors and guidance workers that a science course requires a higher level of intelligence than do the Arts and Commerce courses is dangerously false insofar as it suggests a kind of casteism in education which may ultimately prove harmful for a balanced social development.

All in all, the findings of the present study, it is hoped, will be of much practical use to secondary school principals, teachers and counsellors who have the responsibility of guiding pupils to suitable avenues of study and work.

Aligarh
Septemper, 1971

Baqer Mehdi

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During the course of my research work I have benefited by the suggestions of many and the practical assistance of quite a few of my colleagues. Among them I would like to express my very sincere thanks to Shri S. P. Arora, Shri C. M. Thukral, Shri P. C. Bansal and Shri M. C. Savita who helped me in the difficult task of test administration and scoring, and to Shri K. V. Nair who was generous enough to examine the text and suggest improvements.

Among those able professors and research workers with whom I discussed the plan of my research in India, and in the United States where I studied for one year, the names of Dr. A. Edwin Harper. Jr., M.A., Ph.D., Dr. H. R. Lindeman, Associate Professor, Teachers College, Columbia University, and Dr. Helen Walker, Prof. Emeritus, Teachers College, Columbia University, stand out most prominently. To the last mentioned I owe a further word of thanks for so kindly reading through the first draft of my thesis.

Finally, I must express my gratitude to my supervisor Dr. Anwar Ansari, M.A. (Aligarh). Ph.D. (London), to whom I owe most of my accomplishments in this piece of research. But for his constant help and encouragement this piece of research would have never seen the light of day. His clear thinking and penetrating insight in matters relating to research have been very helpful to me in traversing the path with considerable ease and smoothness.

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CHAPTER 1

Introduction

I. The Background of the Problem

With the introduction in India of a diversified curriculum at the Higher Secondary stage, allocation of pupils to courses for which they are best suited according to their abilities, aptitudes, interests, and personality qualities has become a problem of great importance. The diversification, unlike before and in the conventional high school system, purports to broaden the secondary school curriculum with the inclusion of quasi-academic (Commerce and Home Science) and Technical and Agricultural courses of study. Both from the point of view of the individual pupil who must attain a standard measure of success in the course of study which he chooses to pursue and from that of our emerging democratic system which for its speedy growth and development needs personnel which can carry out its various programmes with a reasonable amount of success and efficiency, it is not only desirable but also essential that the individual should be helped to find his 'niche' early in life. Emphasizing the need for diversification of pupils at the secondary school stage, the Secondary Education Commission (1953) wrote, "..... our secondary schools should no longer be 'single track' institutions but should offer a diversity of educational programmes calculated to meet varying aptitudes, interests and talents which come into prominence towards the end of the period of compulsory education." (p. 36). Multilateral or multipurpose schools as opposed to 'single track' schools were recommended by the Commission for this purpose. "A multipurpose school", the Commission wrote, "seeks to provide varied types of courses for students with diverse aims, interests and abilities. It endeavours to provide for each individual pupil suitable opportunity to use and develop his natural aptitudes and inclinations in the special course of studies chosen by him." (p. 37). In line with this thinking the Commission envisaged a curriculum for the secondary stage which besides having a 'Core' consisting of two languages, social studies, general science and one craft, exposed the pupils to a variety of specialised groups of study, namely, Humanities, Sciences, Technical, Commercial, Agriculture, Fine Arts, and Home Science. Each pupil was expected to profit from such a scheme by a wise choice of subjects of study. The Commission, however, felt that complete freedom of choice without any guidance from parents or from teachers was not educationally desirable and suggested that for the success of this kind of programme the pupils should get the benefit of expert educational guidance.

Educational thinking in India, since the publication of the Commission's report in 1953, has been greatly influenced by the ideas and recommendations set forth in it. The conversion of High School to a Higher Secondary system in certain States, with a three-year integrated curriculum of a diversified nature, after grade VIII, has been a direct outcome of the Commission's recommendations. The growth of multipurpose schools all over the country (the number increased from 2,115 at the end of the Second Five-Year Plan to around 2,500 at the end of the Third Five-Year Plan) too is in line with the thinking of the Commission with regard to the diversification of courses at the Secondary stage.

The need has, therefore, been felt among educational workers and experienced guidance-counsellors for devising tools and techniques which would enable them to help pupils to choose courses which would ensure a certain standard amount of success in their educational endeavours.

In the absence of any empirically established criteria for guiding pupils in the choice of curricular courses offered, our counsellors try at best to work on kinds of belief which are perhaps detrimental in the long run to the pupil himself as well as to the society. It is commonly held, for example, that Science courses require a high intelligence, whereas a Commerce or a Humanities course requires only an average level of intelligence. The pitfalls of such a belief are obvious.

II. Purpose and Scope of the Present Investigation

The present study was, therefore, undertaken to find an answer to the question : Are there certain factors which are related to the success of a student in certain areas of specialization ? In other words, does there exist a differential pattern of factors required for successful performance in different courses ?

Specifically the study attempted to determine : (i) the combination of factors that seems to give the best relationship to academic success in each area of specialization; and (ii) the factors that seem to differentiate students in one course of study from those in another significantly enough to warrant further study.

Educators subscribe to the view that certain dimensions of pupil development (e. g., cognitive organization, personality, felt interests) are critically related to his school success. Among these, cognitive factors have repeatedly shown up in prediction studies of pupil success and have lent themselves to a comparatively more reliable and vaild measurement. Besides, they have appeared with such consistency in independent studies that they have assumed the status of theory beyond statistical empiricism. No attempt has so far been made in India to study on a systematic basis the relationship of these factors with pupil success at the secondary stage, especially in the context of the present reorganization of the secondary school curriculum. In view of the ever-increasing number of our school-going population the problem of providing curricular guidance to pupils at the 'delta' stage (grade VIII) assumes a measure of urgency such as has never been experienced before. The study purports to provide practical guides to the solution of a major problem facing pupils at the 'delta' stage, viz., the problem of wise curricular choice. In the long run, it might help solve such problems as school drop-outs, high rate of failure in the secondary school terminal examination, and falling standards.

As may be seen, it is not a study in prediction in the usual sense of the term but is intended to provide an objective, i. e., factorially determined, basis of relating scholastic achievement of pupils reaching the 'delta' stage with types of curricular courses they choose to pursue and, incidentally, to provide statistical clues for later differential prediction studies.

III. Assumptions Uderlying the Study

1. By the time children reach the age of fourteen or so they have developed, under conditions of learning in the pre-delta classes and past experiences, certain kinds of abilities, interests, and study habits which tend to differentiate them from one another.

2. Furthermore, these abilities, interests, and study habits have stabilized to the extent that they can be used as means of predicting future academic success.

3. The curricular courses in themselves are sufficiently differentiated to warrant such a study.

IV. Statement of Hypotheses

Certain kinds of abilities seem to be specifically related to certain kinds of courses. It is hypothesized (i) that the abilities required for success in the three courses under study will differ in kind or degree or both; and (ii) that it is possible to differentiate between the successful candidates of the three courses at the beginning of the three-year course with the help of the ability measures used.

V. Implications of the Present Study

It is hoped that the differential pattern of abilities for success in the three courses emerging out of this study will provide an empirical basis to the counsellor for determining which abilities are specifically related to which course. Validation and cross-validation studies of prognosis of counsel on pupil's curricular choice may be conducted on the basis of the findings of this study.

VI. Delimitation of the Problem

In view of the great diversity of factors which are presumed to be required for success in academic, quasi-academic, and technical courses now available at the secondary stage, and also in view of the fact that the number of groups offered in the Higher Secondary schools still varies a great deal in any single State, besides other practical reasons, involving time, money, and non-availability of certain standard measures required in a comprehensive study of this kind, the present study was confined to the three more widely offered courses, namely, Humanities (Arts), Science, and Commerce. Only known (i. e., factorially established) abilities besides interests and study habits were covered by this study. The major emphasis was, however, on the determination of ability factors alone. The purpose in including study habits for all the three groups and interest for the Science group only was to see how far measured study habits and interest helped in improving the prediction of academic success at the higher secondary stage. No differential analysis was intended in this regard.

VII. Definition of Terms

The term 'factor' in this study refers to that distinguishable and operationally definable mental (intellectual) or personality quality which can be measured with a fair amount of objectivity, reliability, and validity.

The use of the term 'success' is restricted to the successful completion of a course of study at the end of grades IX, X and XI without any intervening failure.

CHAPTER II

Review of Relevant Research

I. Previous Reviews of Prediction Studies

The study of factors related to academic achievement has been a problem of continuing interest to psychologists. Convinced of the practical usefulness of predicting the future academic success of the pupil in school by means of information relating to his abilities and personality qualities they have gone on with unending zeal to find out which factors or factor combinations are the most promising in prediction work. The studies made during the last four or five decades in attempts to discover ways of predicting achievement in schools and colleges now easily run into several hundred. The greater part of the literature dealing with prediction of general achievement is at the college level.

Interest has also been focussed, particularly in Great Britain, on prediction of post-primary school ability with a view to regulating admission of pupils to secondary schools imparting education with predominantly academic, vocational, or technical bias.

At least four comprehensive reviews of studies in the field have appeared. Harris (1931) summarized the results of past investigations in the field dealing with school as well as college grades, concentrating mainly on factors other than intelligence. Such factors as attitudes, study habits, interests, extra-curricular activities, age, health, outside work, recreation, and personality, etc., have been attempted. In another review of litrature, Harris (1940) covered the period from 1930 to 1937. Speaking of intelligence, Harris pointed out that although more and more attention had been paid to factors other than intelligence the importance of this factor was ever with us. The correlations with grades reported in various investigations range from ·37 to ·69. It was noted that at a number of places intelligence test scores were found to be the best single predictors of grades. Another important predictor which came to light was the high school grades. High school grades were found to show a higher correlation with college grades by a sizable number of investigators. The correlations reported are mostly in the ·60's and ·70's going as high as ·78.

Three shortcomings from which many of the investigations suffered were pointed out by Harris. They were : (i) heterogeneity of subjects (pupils), (ii) failure to hold intelligence constant, and (iii) failure to present results in terms of statistical reliability. On the basis of his impressions based on study and experience Harris concluded that the essential factors in student achievement, in the order of their importance, are :

1. Ability (or intelligence, or scholastic aptitude, etc.)
2. Effort (or drive or degree of motivation, etc.)
3. Circumstances (personal, social, economic, academic, etc.).

While the first two factors are pupil-centred and therefore a subject of major psychological import, the third is largely a product of home-school-neighbourhood complex.

Two more excellent reviews, one by Travers (1949),and another by Garrett (1949), need to be mentioned. A closer study of these reviews leads one to the following general conclusions ; (1) Most of the studies up to the end of the forties are concerned with the relative merits of various prediction devices at different levels of the student's life. Chief among these devices are intelligence tests, standardized achievement tests, school grades, and teacher judgment; and (ii) the studies are carried out with a view to improving selection techniques.

Bearing on the relation of pupil performance in school subjects and tests, various studies report correlations between objective measures of elementary school achievement and intelligence measured by such tests as the Kuhlman-Anderson, the Revised Stanford Binet, and the National Intelligence Test. Correlations between intelligence tests and achievement in academic subjects are between 0·5 and 0.75.

Attempts at long range predictions of college success have also been made by establishing the relationship between intelligence quotients measured at an early age and subsequent college success. Rosenfeld and Nemzek (1938) found a correlation of ·21 ± ·05 between intelligence puotients in the first grade and index of college success in terms of honour points earned in college. Keys (1940) found a correlation of ·35±·07 between college grades and intelligence quotients measured before the age of fifteen. Billhartz and Huston (1941) found similar results from these data. As may be seen, the correlation coefficients are low. The method of correlating an earlier level of test performance with a very much later achievement may be open to question on psychological grounds, chiefly because intervening development (maturation and growth) is not accounted for. It may be concluded that measures of intelligence obtained before the ninth grade have limited value for individual prediction of academic success in college.

II. The Problem of Differential Prediction

The problem of differential prediction, especially at the secondary level, did not catch the attention of research workers until Thurstone's work on primary Mental Abilities became well-known. At the college level, however the American Council on Educational Psychological Examination permitted some differential prediction in so far as different subject-matter fields require varying amounts of verbal and mathematical aptitudes. On the ACE Psychological Examination the L (Linguistic) score tends to be more highly correlated with English, foreign language, history and science; and the Q (Quantitative) score correlates more highly with mathematics.

In reviewing studies of Thurstone's Primary Mental Abilities Tests for predicting grades, Goodman (1949) found that the verbal ability test correlated better than any other primary mental ability test with semester point average and with individual college courses, but the individual sub-tests coorelated with success in individual subject-matter fields in the way in which common sense would suggest. English scores correlated highest with the verbal factor, and mathematics scores correlated highest with the numerical, induction, and deduction factors. The correlations were generally low. But as Travers (1949) has pointed out, the relatively low values of the correlations between scholastic achievement and the primary mental abilities tests suggest not that the factorial approach has little value but that the Primary Mental Abilities Test does not measure all the major factors that contribute to academic success.

Butsch (1939) investigated differential prediction from the subject-matter tests in the Iowa High School Content Examination, rank in high school, and the ACE Psychological Examination. He found that, by assigning differential weights to the components, prediction of success could be materially improved in the colleges of Business Administration, Engineering, Journalism, and Liberal Arts.

Coming to differential prediction at the secondary school level Travers (1949) noted that apart from the trend in recent years toward the development of prognostic tests for specific subject-matter fields there has also been a trend toward the breaking down of measures of intelligence into various components. In a study of the Junior Scholastic Aptitude Test, Traxler (1941) found that the correlation of the verlba scores with English marks and with marks in foreign language tend to be ather high and so also are the correlations between the numerical scores and mathematical marks.

The most extensive effort to study the relationship ol special ability factors with secondary school success started with the widespread use of the Differential Aptitude Tests (DAT) by Bennett, Seashore and Wesman, published by the Psychological Corporation in 1947. This battery goes considerably further than the Junior Scholastic Aptitude Test in providing separate measures of various abilities. The eight tests included in the battery are: Verbal Reasoning, Numerical Ability, Abstract Reasoning, Spatial Relations, Mechanical Reasoning, Clerical Speed and Accuracy, Language Usage I–Spelling, and Language Usage II–Sentences. Extensive data have been presented in the D.A.T. manuals showing relationship of these abilities with different subject-matter fields. It may be generally concluded that tests of numerical reasoning aptitude have good predictive value for courses which are mathematical in nature. Verbal factor tests predict in the verbal learning areas. Space perception aptitudes are useful for predicting performance in engineering drawing and in subjects in which space perception plays an important role. Current guidance practice tends to use only the verbal reasoning and the numerical reasoning type of tests for predicting academic success (see D. A. T. Manual, 1959).

Recently some more promising multifactor test batteries have appeared on the scene. Main among these, from the point of view of school use, are: (1) the Holzinger-Crowder Uni-Factor Tests (1952-55), and (2) Multiple Aptitude Tests (MAT) by David Segel (1955). Super (1956) in a leading article on the use of multifactor test batteries has discussed several basic issues relating to the use of the kinds of tests in guidance and counselling. His article introduces a series of other articles on the available multifactor test batteries. It seems that not much effort has so far been made in the direction of combining various test scores in the form of regression equations to predict success differentially in major areas of study like Humanities, Science, Commerce, etc., though this alone seems to be a more sensible approach to academic prediction with these kinds of tests which, taken singly, tend to be poor in terms of their predictive validity. As Super (1956) puts it: "The lessened predictive value of the multifactor tests is the price of versatility." (p. 13). Group factors will serve a prognostic purpose only when regression equations are constructed about the criterion. Here too they are bound to differ from institution to institution, depending on the specific objectives to be served by the curriculum, pattern of instruction, and evalution, provided for in the course offerings. Conclusions based on specific test results for specific courses seem hazardous at this stage because consistent results have not been obtained when these tests have been used as separate measures for separate subject-matter areas. As has been pointed out by Berdie (1969), "......tests such as these perhaps cannot predict how successful men will be on a job but rather can serve to differentiate among persons who enter in and are minimally successful in different occupations." (Pp. 612-13 - *Fifth Mental Measurements Yearbook*, 1959: Review by Berdie of the Multiple Aptitude Tests by David Segel and Evelyn Raslkin).

In a recent edition of her book *Psychological Testing* Anastasi (1961) has tried to present a synthesis of researches on the various differential aptitude test batteries. Speaking of D.A.T. she points out that the results are somewhat less encouraging with regard to differential prediction. "Although, in general, verbal tests correlate more highly with English course, there is evidence of a large general factor underlying performance in all academic work. Verbal Reasoning, for example, gives high correlation with most courses." (p. 360). In the case of Holzinger-Crowder Uni-Factor Tests which have aimed more deliberately than most other batteries toward factorial purity and independence of factor scores, Anastasi points out that some promising evidence of differential validity is available.

III. Non-intellectual Factors in Academic Achievement

A word must be said about the status of research with regard to the use of non-intellectual measures in predicting academic achievement. After reviewing studies of the relationship of measures of personality qualities (traits) to achievement in college, Garrett (1949) wrote: "Although admirable progress has been made in discovering and attempting to measure the factors which contribute to scholastic success in college, all writers agree that there still remains a unique unmeasurable factor or perhaps factors lost in the unpredictable intricacies of human personality." (p. 20). Middleton (1959) pointed out that "attempts to improve prediction by using non-intellectual factors such as interest and personality traits have yielded quite discouraging results." (p. 66). The principal sources of difficulty according to him appear to lie in "the heterogeneity of the criterion and the non-summative and non-linear properties of many promising predictors." (p. 66).

While there have been a large number of studies of the motivational and other non-intellectual factors related to academic achievement at the college level, not much work has been done at the elementary and secondary levels.

Stagner (1933), reviewing the literature on the relationship of personality to academic aptitude and achievement, point to the increasing recognition of the fact that personality factors influence achievement by affecting the degree to which use is made of the individual's potentialities. Hinkelman (1952) investigated this hypothesis and found positive results. He used Johnson's Temperament Analysis for personality ratings which avoids the clinical syndromes and the adjustment-maladjustment notion for a trait concept. He found that, among the personality traits investigated, three, namely, "objective", "composed" and "self-mastery" have the strongest relation to achievement in selected subject-matter fields. Other traits, namely, "appreciation", "submission", and "active", although important to a lesser degree yielded statistically significant coefficients. Hinkelman concluded that when personality trait relationships are considered with the basic factor of intelligence, we can predict academic achievement better. The problem is to relate 'trait-gestalt' with 'ability-gestalt' in significant ways to serve as total predictors.

Borenz and Kaufman (1960) pointed to the following few characteristics which they maintain have been frequently found in either enhancing or interfering with the child's school performance.

1. Curiosity
2. Appropriate aggressiveness
3. Positive identification
4. Appropriate skepticism
5. Healthy masochism
6. Ability to concentrate

Generally speaking, anything that enhances these characteristics increases the effective use of intelligence in children. Conversely, anything that reduces or interferes with the above attributes reduces intellectual efficiency.

Persistence as a factor in achievement has been studied by many researchers—Ryan (1938), Thornton (1961), Edminston (1948), to name only a few. But attempts to develop measures of persistence to predict achievement have not met with appreciable success. Bond (1953) found that all groups of pupils with poor scholarship records ascribed "lack of persistent work at difficult task" as a prominent reason for low marks. All groups of pupils with low marks gave as a major reason for inferior scholarship the fact that lack of success in study had developed dislike for study with consequent insufficient attention to it. The same group consistently claimed that it was difficult to improve study habits.

Studies of the relation between scores on interest tests and academic success have also been of limited value. Reviewing the research undertaken to relate scores on interest tests with measures of achievement, Travers (1963) concluded : "In summary, data generally demonstrate a very small relationship between interest measures and measures of learning, and these relationships tend to be too small to be of practical significance." (p. 180). Commenting further, he says: "If interests function as motives, then they appear to function as very weak motives, for individuals learn almost as rapidly in areas for which they express little interest as in areas for which they express high interest." (p. 180).

The reason for interest tests being of limited value in prediction of academic success may be that interest tests, which, by and large, are in the form of inventories, do not admit of rigorous statistical analysis. It may also be, as pointed out by Travers (1955), due to the fact that most of the studies are based largely on interest tests which were developed for non-scholastic predictions.

Social and emotional factors affecting academic performance of high school students have also been investigated in a number of studies [see Gough (1953), Ford (1957), and Duff and Segel (1960)]. Among the factors analyzed were social class, home conditions, peer relations, aspiration levels, and academic inclination. Ford (1957) has cautioned against drawing generalizations from these studies, including his own, employing limited data.

IV. General Conclusions

Summing up, the remark made by Travers (1949) concerning the complexity of factors involved in academic achievement emerges out most patently. He states: "The viewpoint behind these studies is based on the assumption that the individual's own characteristics are entirely responsible for his success or failure and that the person who has the right aptitudes will inevitably succeed. This idealistic viewpoint hardly seems tenable in our type of society where unplanned events are likely to influence a person's entire career." (p. 294). It is commonly observed that pupil-teacher or parent-child relations, poverty, persistent ill-health, unforeseen happening in the life of the child or his family, contribute in no small measure to his (child's) achievement in school. Events such as these are not covered by data available from tests or from other sources easily accessible to the teacher or the counsellor.

Nevertheless, it is worthwhile to note some of the more accepted conclusions which have come from generally accepted studies. They are enumerated by Garrett (1949) as follows. It may be noted that they are mainly based on college studies.

1. There is no correlation apparent between physical factors and college achievement.

2. Interest tests and personality tests add very little, if anything, to intelligence as a predictor of college success.

3. Employing a third variable adds but little to a two-variable combination, and adding a fourth does not at all improve it.

4. Multiple coefficients of correlation between factors and the criterion are rarely higher than .80.

5. The greater part of the differences in the academic achievement of college students is still largely unaccounted for by prognostic instruments now in use.

It will be interesting to keep these points in mind in the evaluation of the present study.

CHAPTER III

Method and Procedure

I. Design of the Study

The present study was designed on a follow-up basis. Pupils entering grade IX in the three courses, namely, Science, Humanities, and Commerce were studied for a period of three years in order to see which of the factors covered in the present study showed a significant relationship with the ultimate success at the end of grade XI when they took a public examination. Speaking of this method to be almost always the preferred method of studying factors related to educational outcomes, Thorndike (1963) wrote : "The basic design of prediction over time gets us involved in the smallest number of questionable assumptions of any correlational method, and is widely useful." (p. 35). Relationship with intervening success at the end of grades IX and X was studied for purposes of comparison and noting the stability of factors once found significantly related to pupil success at the end of grade IX.

II. Considerations in Selection of Schools

A research study cannot lend itself to generalizations unless its results are based on a sample which truly represents the population to which the study refers. As the present study was to be confined to the urban school-going population of boys in Delhi, care was taken to select schools which would represent this population.

The following points were borne in mind in the choice of schools.

(i) Only those schools were selected which were considered to be neither 'very good' nor 'very poor' in terms of the socio-economic class to which they catered, methods of teaching employed, and pass percentage.

(ii) Care was also taken to select those schools which used the same kind of evaluation techniques. Preference was given to that group of schools which administered the same set of tests at the time of the annual examination.

(iii) Only boys schools were selected for study.

(iv) Sectarian schools which catered mainly to one class of population like Bengalis, Punjabis, Madrasis, etc., were not considered. Nor were those schools considered which were catering mainly to the needs of a particular category of occupational class like government servants, railway employees, factory workers, etc.

As far as possible only those schools were selected which had at least one hundred students in each curricular group at the beginning of the three-year course.

III. Nature and Size of the Sample

Care was also taken that the sample represented a cross-section of pupils in the total ability range.

An assumption was made at the time of testing that pupils were not randomly distributed in the three courses at the time of admission so far as general ability level is concerned—that the Science course attracts a larger number of pupils possessing a higher level of general mental ability, leaving the Humanities and Commerce courses poorer in that respect. This necessitated testing a much larger group of pupils in the three courses in order that selection of sufficient number of pupils, with comparable ability level and range, could be made at the end of the testing. Around 350 pupils in each group were tested.

IV. Testing Procedure

A pre-requisite of testing was the selection of a battery of tests o "primary" mental abilities, which have been found to be sufficiently reliable. An interest test and a study habits inventory were also used. The testing was done soon after the pupils had taken admission in the respective courses. This was necessary to ensure against any effects of actual training in the course of study on later success. As far as possible uniformity in testing conditions was maintained throughout the testing period. Due attention was given to accuracy at the time of scoring the test scripts.

V. Procedure for Statistical Analysis of Test Data

For the purpose of tatistical analysis of the test data the following procedure was used:

1. The inter-correlations of the predictor variables were worked out for the three groups separately.

2. At the end of grade IX the average score in the major subjects in each course was used as the criterion variable, and product moment r's were worked out.

3. In deciding about factors predictive of success in different courses the correlation between each test and the criterion was studied by testing each for significance. The tests were then combined to compute multiple R, by Aitken's method of pivotal condensation,[1] in order to see which combination of factors gave the best prediction for a particular course thereby deciding upon the relative importance of overlapping factors for success in the different courses under study. This method is particularly useful because it helps in obtaining beta coefficients at each successive stage, besides being easy and amenable to checks and cross-checks at every stage of computation. The beta coefficients give the weights to be attached to the scores of each independent variable when Xo (predicted score) is to be estimated from all of the combinations. They also give the relative importance of each variable in a predictive formula.

4. At the end of grades X and XI biserial r's were worked out, using 'pass' and 'fail' as the dichotomy in the criterion variable. With the help of a simple analysis of variance technique, the mean difference in scores on the predictor variables for the two 'pass' and 'fail' groups were studied for significance. The differences in mean scores on predictor variables among the successful candidates of the three courses were also studied for significance with the help of the analysis of variance technique.

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[1] A fairly simple and straightforward description of the method can be found in Sir Godfrey Thomson's *Factorial Analysis of Human Ability*, 5th Edition, University of London Press Ltd., 1951, Ch. XIV.

CHAPTER IV

Test Materials Used and Groups Studied

I. Selection of Test Materials

In the selection of tests for the present study certain considerations were kept in mind which, it was thought, would enable the researcher to find answers to the questions raised in Chapter I.

Firstly, it was considered that the tests should conform to the known ability factors generally held to be important in academic work at the secondary stage. Practical considerations precluded the use of personality tests or other measures known to have some relationship with school achievement at the secondary stage. However, it was considered possible to include among the test variables an interest inventory for the Science group (as this alone was available at the time of the study) and a study habits inventory for all the three groups, namely, Science, Arts, and Commerce. Their inclusion was considered to be particularly helpful because of the generally held belief that interest and study habits are the two most important non-intellectual factors in pupil success.

A second major consideration kept in mind in the selection of tests was their relatively pure factorial quality. As has been pointed out by Guilford (1956) : "Factor tests provide a broad coverage of human traits in a very economical manner. They provide both for highly valid weighted combination of scores for predicting success in particular activities and the basis for differential prediction." (p. 219). In any programme of differential prediction it is important to have a good set of differential predictors such that the intercorrelations among the predictors be low. The use of tests which intercorrelate highly among themselves is not only uneconomical in a differential prediction programme but is also less effective from the point of view of differential validity. As may be easily seen, an important condition to be satisfied by a set of differential prediction variables is that a certain variable have a high correlation with one or a few of the criterion variables and low correlation with the others. Conversely, another predictor variable should have the reverse relationship with the criterion variable. In other words, the relationship of predictor variables with the criterion variables should be such that none of the predictor variables supplant (make superfluous) another predictor variable but reinforce the significance of the other in predicting the criterion variables. That is, it is a critical requirement for each test to have different validities for the different criteria. As has been pointed out by French (1956), "This differential validity is more likely to occur if the tests in the battery are highly independent one from another. Use of pure factor tests or factor scores is one way to heighten chances of reaching this goal." (p. 43).

A limiting factor in the selection of tests is the total time they require in administration. Schools usually resent the researcher taking any considerable portion of pupils' time for purposes of a research study. Students too become non-serious if they are subjected to long periods of testing. They are also likely to develop a test bias either from emotional or temperamental causes which may help some of them to do better as the testing continues, while some others might feel handicapped in maintaining an optimum level of cognitive efficiency. Request for more than two to three class periods of pupils' time is not usually granted by the principal. It was therefore necessary to select such tests as, while fulfilling their functions efficiently, would keep the testing time to a minimum.

Furthermore, it was important for this study that the tests to be selected were already developed for use with Indian students and their reliabilities worked out on populations from Indian schools.

A final consideration was their ease of administration and scoring.

With these considerations in mind the Predictive Battery of Differential Scholastic Aptitude (1958), developed at the University Training College, Nagpur, Madhya Pradesh, was selected for use.[1] The battery consists of nine tests, viz., Numerical, Verbal, Inductive Reasoning, Deductive Reasoning, Spatial, Perceptual Speed, Finger Dexterity, Rote Memory, and Physical Relations.

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[1] For technical information about the battery see Technical Report typed out in full in Appendix A.

II. General Characteristics of the Battery

The battery is intended for use with pupils at the higher secondary stage and is based on the multiple-factor theory of mental ability. The main idea behind its development was to produce a tool which could differentiate among aptitudes for different subjects (or subject groups, as in the multipurpose scheme) in terms of independent test scores. A battery of tests of maximally independent functions for the 9th grade of the High/Higher Secondary School, it was thought, would predict the probable efficiency with which any given student may take some of the available optional courses at that stage.

The items used in the tests represent various mental functions which, according to the technical report, "had shown in previous factor studies pure loadings in factors which gave names to the tests. Thus Verbal was represented by antonym-synonym type of items which had shown an average loading of ·80 in the factor in two studies, uncontaminated by any other factor."

The battery is available in both Hindi and Marathi versions. Preliminary validity studies with the tests showed that these tests were required in different combinations for predicting success in different school subjects. No attempt, however, appears to have been made to study their practical usefulness in predicting success in various curricular groups at the higher secondary stage.

III. Description of Tests

Following is a description of the tests actually used in the present study. So far as the Nagpur battery is concerned all the tests except the Finger Dexterity were used.

1. **Numerical.** The test measures number ability by using the four fundamental processes of arithmetic—addition, subtraction, multiplication and division. The items become progressively more difficult but the test in spite of this remains primarily a well-speeded test. In the present study, therefore, the term 'numerical facility' has been used to denote the factor measured by this test.

Number of items	:	64
Score	:	One point for each correct response
Response type	:	Productive
Working time	:	12 minutes*

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* The time for each test was fixed on the basis of pretesting, as in certain cases the time given in the manual was found unsuitable for Delhi students.

Sample items : 95 + 25=
120 − 80=
244 × 3=
124 + 2=

2. **Verbal.** The test measures verbal ability which all tests of verbal intelligence are known to assess to the maximum. It is represented here by antonyms and synonyms with six-response choices for each item. The term 'verbal meaning' has been used to denote the factor measured by test.

Number of items : 70 (35 items on antonyms and 35 on synonyms)
Score : Right minus number wrong divided by 5
Response type : 6 choices
Working time : 20 minutes
Sample items : Hindrance means the same as (Flaw, Obstacle, Ease, Growth, Ditch, Endurance).
Ugly has the opposite meaning of (Black, Smooth, Beautiful, Poor, Happy, Angry)

3. **Inductive Reasoning.** It is a letter-series test in which the testee is to find the principle underlying the sequential order in a series of letters and then fill in the blanks with the letters that fit the principle

Sample item : AAA BBB CCC DD — —
Answer : D E

It is a fairly stiff test of inductive reasoning and appears closely to represent the generalized mental function commonly identified with the term 'intelligence'.

Number of items : 50
Score : One point for each correct response, maximum score 50
Response type : Productive
Working time : 40 minutes

4. **Deductive Reasoning.** The test employs scrambled sentences for items and represents the deductive type of reasoning in linguistic medium. The mental operations involved are comprehension and judgment. The words have to be mentally arranged in a meaningful form and then a judgment is to be made whether the statement is right or

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wrong. In the present study the term 'verbal facility' has been used to denote the factor measured by this test.

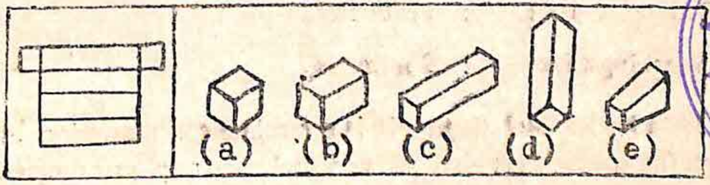
Sample item	:	The wings two has bird. (Translated from Hindi)
Answer	:	Right

This test is rather easy, has a large chance score and is partly loaded with the verbal factor.

Number of items	:	50
Score	:	Number right minus number wrong
Response type	:	two-choice
Working time	:	10 minutes.

5. **Spatial.** It is a spatial manipulation and visualization test. The testee is to visualize how a particular shape of a flat cardboard piece will look like when folded in a particular way to make a box-like object. Five boxes, for each of the 15 shapes of cardboard, are given and the testee is required to say, in each case, whether the box represented can be made or not. On account of the two-choice response, chance factor has to be accounted for in the total score. The test, however, measures a specialized kind of function and is fairly stiff towards the end.

Sample item :



Number of items	:	15, each yielding 5 responses. Maximum possible score 75
Score	;	Number right minus number wrong
Response type	:	Two-choice
Working time	:	20 minutes.

6. **Perceptual Speed.** The test measures pupil's speed and accuracy with simple number and letter combinations. There are six response choices out of which the testee has to choose the correct response. It is the one test in the entire battery which places a heavy premium on speed. It was included especially to see whether it has any relationship with

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success in the Commerce course where some work involves coding, checking and the like.

Sample item 1 2 3 4 5 6
92T4P : 92T4P, P4T29, 429TP, 2P4T9, T94P2, PT294

Number of items : 50

Score : One point for each correct response

Response type : 6-choice

Working time : 6 minutes.

7. **Rote Memory.** It measures speed and accuracy of immediate memory of a purely mechanical type in which the testee is required to recall two-digit numbers which he has learned in association with certain words. The same words in the same order are given after the learning period is over and the testee is to reproduce the right number for each word. Twenty-one pairs of word-number have to be committed to memory in six minutes. Three minutes are given for reproduction. The test was included on the assumption that it might prove of some value as a predictor of success in academic achievement which in our country at least puts a premium on immediate and/or rote memory.

Number of items : 21

Score : one point for each correct response

Response type : productive

Working time : 9 minutes.

8. **Physical Relations.** It is a mechanical reasoning ability test in which the testee is required to comprehend a physical or mechanical principle represented through a picture and select the correct response from the given three responses. It was hypothesized that some aspect of Science course would involve this ability. In the present study the term 'mechanical reasoning' has been used to denote the factor measured by this test.

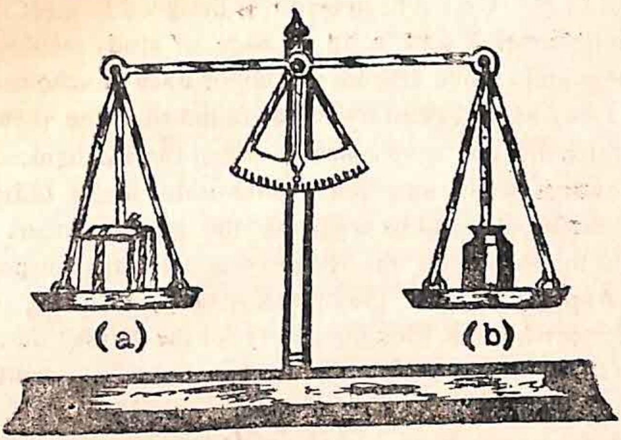
Number of items : 50

Score : Number right minus number wrong divided by 2

Response type : three-choice

Working time : 25 minutes.

Sample item :



Which weights more ? (if equal, mark C)

Besides the above tests, the following two inventories were included among the independent variables.

1. **P.S.M. Interest Inventory (1959).** The inventory was developed by the Educational and Vocational Guidance Bureau, Prantiya Shikhshan Mahavidyalaya, Jabalpur, as a supplement to the tests of general and special abilities used in guidance work. The inventory is in Hindi and consists of 245 items grouped in six categories as follows :

(a)	Occupations	— 70 items
(b)	School subjects	— 30 items
(c)	Leisure time activities	— 60 items
(d)	Educational films	— 25 items
(e)	Things like to own	— 25 items
(f)	Books like to read	— 35 items.

The inventory is developed mostly on the lines of Strong's Interest Inventory except in the standardization and development of scoring keys where Garretson and Symonds approach has been followed. The individual taking the test has to indicate the choice for each item by marking 'like', 'indifferent', or 'dislike' as the case may be. Scoring key for the Science group was ready at the beginning of the present study. So only those items were used which were found valid for this group. Practical consideration of testing time also precluded any attempt at using the inventory for all the three groups. Fifty-four items which were found significant for the Science group were reprinted from the original list so as to form a coherent inventory. The corrected split-half reliability reported for the Science group is ·83. The inventory was administered as an untimed test but the pupils were asked to work as fast as possible. The total testing time needed for the inventory was about 30 minutes. A weighted method of scoring the items was used.

2. **Brown-Holtzman Survey of Study Habits and Attitudes.** The inventory is developed in the United States and is designed to meet the need for an easily administered and valid measure of study methods, motivation for studying, and relaled attitudes of importance in scholastic success. On a close study of the inventory it was found that the inventory included items which did not emphasize so much the mechanics of reading as attitudes towards study and were quite usable under Indian conditions. It was therefore decided to translate the relevant items of the inventory into Hindi and to use the Hindi version for the purpose of this study. (See Appendix C for the inventory used). Scoring key for men was used. Research with this inventory in the United States showed that the inventory was a useful supplement to tests of mental ability in predicting academic success (see Holtzman *et. al.* 1954). Using the 36 item key, the reliability coefficient of the SSHA for men, reported in the revised manual (1956, published by the Psychological Corporation, New York), was found to be ·92 by the split-third estimate. The test-retest reliability coefficient with a two-week interval was ·95 and with an eleven-week interval ·88.

IV. Relevance of Test Variables Used

The test variables described above are those which have been commonly used in studies involving prediction of academic success at the high school and college level. Not all, however, have been found of equal significance.

The results of many factor analysis studies during the last half century have shown that there are definite clustering of mental tests (as shown by the correlations which have been found) and that members of each cluster measure something that is partially separate from what is measured by the other cluster or factor. Ability factors have been established on the basis of such clusters. Starting with the monumental work of Thurstone (1938) on Primary Mental Abilities down to the exciting results obtained by Guilford (1959) in his researches on the "Structure of Intellect" we have a large array of specific factors which have been named. A great deal more research needs to be done before it will be possible to say which of these factors are important and in which situations. Some factors have proved useful in predicting success in school, in industry and in military settings, but the bulk of them have been insufficiently used to determine their practical significance. So far as work in school is concerned the following categories of factors have been well established : Verbal, Numerical, Reasoning, Memory, Spatial, Perceptual, and Speed.

Under each category some more specific factors have also been distinguished. For example, among verbal factors two, namely, Verbal Comprehension and Verbal Fluency, have been clearly distinguished and seem to be very important for school work. Similarly, among Reasoning factors the most clearly determined factors are Inductive Reasoning and Deductive Reasoning. The best established factor of memory is Rote Memory which concerns the ability to remember simple associations where meaning is of little or no significance. However, there is substantial evidence to indicate that there is a factor involved in the retention of meaningful relationships, which is separable from Rote Memory. The factor of Meaningful Memory appears when the student is required to memorize sentences, meaningfully related words, and lines of poetry. The test included in the present study is that of rote memory and not of meaningful memory. It would have beeen better, perhaps, if a test of meaningful memory, instead of rote memory, had been used, but such a test was not available.

Besides the above factors, Spatial Visualization and Perceptual Speed factors also have been well established and have been used in a number of prediction studies, though their importance for the usual types of academic curricula has been found to be small. The inclusion of an Interest Inventory and a Study Habits Inventory is justified on grounds of generally held view that interest and study habits play an important role in school achievement. It will thus be seen that the test variables included in the present study are those which may be considered as most relevant under the present state of research on mental and personality factors.

V. Reliability of the Tests

The reliabilities for the non-speeded tests were worked out by the investigator with the help of the formula.

$$rtt=\frac{n\sigma^2t-M(n-M)}{(n-1)\,\sigma^2t}$$ (See Guilford : 1956, p. 455) in which

n = number of items ;

σ^2t = variance on the test ;

M = Mean on the test.

The formula is a substitute for Kuder-Richardson formula for the non-speeded test. As may be seen, it is an internal consistency formula and depends upon a single administration of a test. Guilford (1956) has pointed out that "all the internal consistency formulas that depend upon a single administration of a test probably underestimate the reliability of a test, this formula most of all." (p. 455).

Table 4·1 gives the reliabilities of the four non-speeded tests. For the speeded tests reliance was placed on the reliabilities given in the manual.

TABLE 4·1

Estimated Reliability Coefficients of Non-speeded Tests of the Battery for Separate Groups

Sample N = 180

Name of the Test	Coefficient of Reliability		
	Science	Arts	Commerce
1. Verbal Meaning	·86	·90	·88
2. Inductive Reasoning	·86	·88	·88
3. Mechanical Reasoning	·88	·83	·82
4. Spatial Visualization	·89	·92	·90

It may be pointed out here that these reliabilities have been worked out on the equated samples from each group which do not include a sufficient number of pupils in the highest and lowest ability groups, as many had to be excluded from each of the three groups because of the uneven proportions in which they existed in the three groups tested. The reliability coefficients reported are, therefore, a conservative estimate of the reliabilities of the tests. In a representative sample of IX grade students the reliabilities would be higher than those reported here.

For the speeded tests and the Rote Memory test the manual reported the following reliabilities.

Numerical Facility	·73
Verbal Facility	·60
Perceptual Speed and Accuracy	·75
Rote Memory	·87

VI. Groups Studied

The reorganization of secondary education in India makes it possible for a student entering grade IX to choose from a veriety of course offerings the one which accords well with his abilities, aptitudes, and interests. Each course consisting of a group of subjects is named after the major subjects which are included in it. Thus the Science group, for example, includes among its major subjects, Physics, Chemistry, Mathematics or Biology. The Humanities (Arts) group includes languages and Social Studies, the latter comprising History, Geography and Civics. The Commerce group includes such subjects as Elements of Commerce, Commercial Geography including Economics, Book-keeping, Shorthand and Typing. Besides the major subjects, included in each group are certain general courses which are intended to bring a balance in the total curriculum for each student irrespective of the group which he has chosen for himself. They are, however, of secondary importance as compared with the major courses and do not count heavily in the final grading.

Although the number of possible groups of curricular courses offered at the secondary stage is seven, the three mentioned above are the most commonly offered ones in the majority of the higher secondary schools in India today. The remaining four groups, namely, Agriculture, Technical, Fine Arts, and Home Science, are often restricted to a relatively few schools. The Home Science course is especially meant for girls. As has been mentioned earlier, the present study is confined to the study of Science, Arts, and Commerce groups only. The predominantly academic nature of these three courses makes differentiation of pupils at the secondary stage more difficult. Much of the problem of educational and vocational guidance would be solved, it was thought, if some clear-cut patterns of abilities could be established for these three courses or if certain tests could prove of differential predictive value in respect of each course.

It is well to remember here that the Commerce course is offered for the first time at the secondary stage. Hence, the concepts to which the student is introduced are entirely new to him. This is not the case so far as Humanities and Science courses are concerned. Languages and arithmetical concepts are taught right from the elementary stage and some rudiments of science are introduced at the junior high school stage. However, in the Science group too the subjects of Physics, Chemistry and Biology *per se* are fairly new to the pupil at the higher secondary stage, though instruction in General Science does familiarize him to everyday instances of physical, chemical, and biological phenomena. It is to be seen whether this makes for any difference in the effectiveness with which success in the Commerce and Science courses can be predicted by means of the tests included in this battery.

From an analytic study of the three courses it would appear however that the Commerce course would differ most from the other two courses in its greater practical emphasis. This is a point which needs to be considered in the interpretation of predictor-criterion correlations for this course.

CHAPTER V

Collection of Data

I. Selection of Subjects

In view of the large number of tests to be used in the study and the practical considerations involved in test administration and scoring it was decided to limit the testing programme to as few schools as possible provided availability of number of students for each of the three groups was ensured. Limiting the number of schools was also considered important from the point of view of controlling such factors as quality of teaching, system of grading and other motivational factors that lie within the school. It was obvious that unless these factors, which appeared so important in pupil success, were controlled the results of the study would be difficult to interpret. Three schools of two large school groups of urban Delhi, namely, the Ramjas and the D.A.V., which cater to a heterogeneous population representing all classes and income-groups and including within their fold wide ranges of mental ability were chosen for this study. Two more schools of the same standing located in the same area had, however, to be added since the three schools in the two groups included in the study did not yield sufficient number of students in the Humanities group—a group not so popular in Delhi, especially among the middle-class and the upper-middle-class people. It was decided to test each section of the IX grade in these schools until a sufficient number of pupils had been tested. A sample of 350 to 400 students in each group was aimed at.

II. Test Administration

The school session in Delhi starts in the middle of July. Students take about two to three weeks to settle down and finally decide about the courses they would like to take. Testing was therefore, deferred until the first week of August. The investigator approached the principals of the respective schools personally and explained to them the purpose of the study. In all, six class periods each of 35 minutes' duration were needed to test each section. Administration of tests to each section was to be completed in two sessions on two consecutive days. For the Science group a third day was needed to administer the additional interest inventory. The tests in the battery were grouped into two halves, each half requiring approximately the same amount of testing time. Separate answer-sheets were designed so as to facilitate the process of administering and scoring the tests. The test-booklets and answer-sheets were so arranged as to take the least amount of time in distribution and collection. The investigator was assisted by two of his colleagues in test administration. During the summer the classes are held in the morning ; hence most of the testing was done between 7 a.m. and 10 a.m. Only in a few cases where the testing had to be done in the afternoon shift, tests were administered between 2 p.m. and 4 p.m. The persons who assisted the investigator were thoroughly familiarized with the instructions and timing for each test. A stop-watch was used to keep record of the time. No changes were made in the seating arrangement of the class and the testing was done in the normal classroom setting, which allowed pupils sufficient space to conveniently use separate answer-sheets. Each section had a uniform arrangement of tables and chairs. With a view to elicitting best and honest response from each testee a brief introductory talk preceded the testing proper. This was intended to control the motivational factor and guard against slipshod work on the part of the testees.

The academic session during which the testing was done was 1961-62.

Table 5·1 gives a summary description of the names of the schools, the number of class sections tested in each group, and the number of students involved.

TABLE 5·1

Names of the Schools, the Number of Class Sections Tested, and the Number of Students Involved

Name of the School	Number of Class Sections Tested			Number of Students Involved
	Science	Arts	Commerce	
Ramjas Higher Secondary School No. 4	2	1	3	254
Ramjas Higher Secondary School No. 5	4	2	4	416
D.A.V. Higher Secondary School	—	3	2	206
Salwan Higher Secondary School	3	2	—	192
Harcourt Butler Higher Secondary School	—	1	—	36
Total Number of Students Tested	364	326	414	1104

It will be seen that, in all, twenty-seven sections involving 1,104 students were tested, of which 364 were in Science, 326 in Arts, and 414 in Commerce. Considering 200 minutes as average time for testing each section, the total amount of time spent in testing was about 90 hours, With two testing sessions a day the testing was completed in about a month's time with the help of two assistants.

Scoring of the test scripts took considerable time. More than 10,000 test scripts were scored and checked for accuracy. Help of two other assistants was sought in the scoring of the test scripts. The investigator, however, rechecked the scoring of each script himself.

III. Criteria Used

At the end of the school session, IX grade annual examination marks of each student were collected. It was decided to use the composite standard scores in the major subjects as one of the criteria for each group. In using this criterion the major subjects considered in each group were as follows :

1. Science : Physics, Chemistry and Mathematics
2. Arts : Hindi and English (Social Studies could not be included because the schools still continued to offer either Geography or History to their students)
3. Commerce : Economics, Commerce and Mathematics

A second criterion involving total performance in the courses indicated by pass-fail was also used in order to see the difference it made in factor-patterns for success.

For the X and XI grades, however, the only criterion used was the pass-fail results. At both these levels the 'fail' group comprised all those students who failed at any of the grade levels starting from IX. This afforded full utilisation of the sample at each grade level, and also made the difference between 'fail' and 'pass' groups sharper at each succeeding level. Thus the 'pass' group at the end of grade IX which still included a large number of potential secondary school failures became somewhat pure at the end of grade X. But it was only at the end of grade XI that the finally successful group could be identified. The use of this criterion becomes meaningful when it is considered that (a) completion of the courses at grade XI alone is tantamount to completion of the higher secondary course, and (b) prognosis based on differential-predictor scores computed for grade XI is significant for purposes of counselling pupils and suggesting improvements in the course curricula, instructional methods and evaluation techniques.

Yet another advantage of this criterion was the possibility it afforded to study the stability of factors over a period of three years and the confidence it gave in using them for prognostic purposes. It may also be pointed out here that the pass-fail criterion is more inclusive (as it takes into account all the subjects studied) and perhaps more reliable criterion to be considered than marks in the two or three major subjects alone. The latter, however, has the advantage of being a more 'pure' criterion inasmuch as it involves pupil performance in major subjects alone.

CHAPTER VI

Analysis of Data and Results (I) —Factors in Pupil Success

I. General Procedure for Treatment and Analysis of Data

The investigation may be conveniently divided into two parts for treatment and analysis, although the parts are closely related. Part I, to be discussed in the present chapter, is concerned with the relation of selected variables to academic success in each of the three courses, namely, Science, Arts, and Commerce. Both the correlation analysis technique and the technique of analysis of variance are used to study the relationship. Whereas product moment r's are calculated to study the relationship between independent variables and the school marks at the end of grade IX, biserial r's are computed to study the relationship between the independent variables and the pass-fail criterion at the end of grades IX, X, and XI. Analysis of variance technique is used with the IX, X, and XI grades data to get a clearer picture of the differences between successful and unsuccessful candidates in each of the three groups and to check for confirmation the results obtained through the correlation analysis. In order to study the relative importance of variables found to be significantly related to a particular curricular course, multiple regression technique is employed at the end of grade IX. Beta coefficients and later multiple R's are worked out with the Aitken's method of pivotal condensation. The best combination of variables for maximum correlation in each course has thus been determined.

Part II, to be dealt with in the next chapter, is concerned with the likeness and differences among the successful students in the three courses. Analysis of variance technique is used to see which factors, if any, differentiate between the successful candidates of the three courses.

II. Need for Having Equated Samples

When the scores on all the variables were obtained, it was thought best to proceed with the calculation of inter-correlations among the test variables which were ultimately needed to obtain the beta coefficients and the multiple R's. Moreover, they were needed for a better understanding of the battery as a whole and for the interpretation of results. A casual observation of the scores obtained by the three groups on different tests, however, made it necessary as a first step in proceeding with the study to equate the three samples.

It was observed that the Inductive Reasoning test which was closest to measuring the 'g' factor was showing marked differences between the three groups. There was concentration of high scores on this test in the Science course and of low scores in the Arts course, which clearly showed that the two groups were in no way comparable in their general level of intelligence to start with. Marked liking for Science subjects among pupils at the secondary stage coupled with the parents' efforts to get their children admitted to the Science course had obviously tilted the balance of intelligence in favour of this course. A kind of built-in screening by ability had taken place, which had resulted in the more intelligent children concentrating in the Science course and the less intelligent in the Arts course, with the Commerce course taking the middle position.

Table 6·1 gives the frequency distribution, mean, and standard deviation of scores on the Inductive Reasoning test for the three groups.

TABLE 6·1

Frequency Distribution, Mean, and Standard Deviation of Scores on the Inductive Reasoning Test for the Science, Arts, and Commerce Groups

Class Interval	Science		Arts		Commerce	
	f	*Percentage*	*f*	*Percentage*	*f*	*Percentage*
44—47	8	2	0	0	0	0
40—43	12	3	2	1	6	1
36—39	28	8	6	2	9	2
32—35	56	16	12	4	22	5
28—31	58	16	23	7	31	8
24—27	53	15	33	10	54	13
20—23	46	13	42	13	60	15
16—19	34	9	41	12	55	13
12—15	22	6	33	10	36	9
8—11	16	4	33	10	38	9
4—7	15	4	42	13	36	9
0—3	16	4	59	18	67	16
N=	364	100	326	100	414	100
Mean=	24·73		15·28		17·04	
S.D.=	10·47		10·38		10·56	

Figure 6·1 shows three overlapping frequency polygons representing distribution of scores given in Table 6·1.

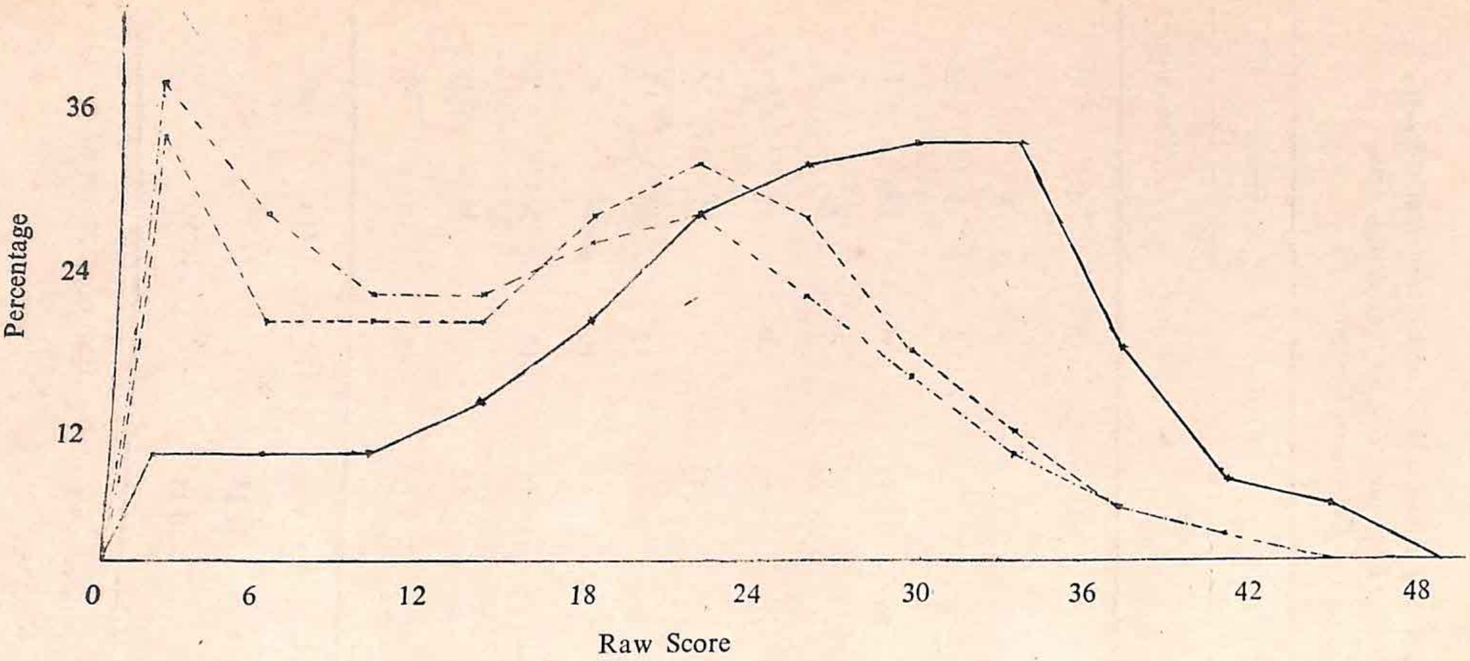


Figure 6·1 Three overlapping frequency polygons representing distributions of scores on the Inductive Reasoning test for the three groups—Science, Arts, and Commerce.

It soon became apparent that if the study was continued on the total number of pupils tested in each group it would lead to results which would not justify the testing of the hypothesis posed at the beginning of the study, namely, that there are differential patterns of aptitudes for success in the three courses, and would end up in a kind of straightforward predictive validity study. Validity studies are useful in their own way but they are uneconomical in that they do not tell us of any stable relationship between the variables and the criterion which they predict. It is well known that regression equations vary from one study to another depending on the differences in the samples studied, reminding us that each institution should develop its own regression equations for a battery of tests. That is neither feasible nor economical under our present conditions of availability of technical personnel in India. If the counsellor has to be helped to become more effective and perhaps more efficient in his job of helping pupils to choose the right course of study, he must be provided with some basis of knowing what goes with what so for as success in the different courses is concerned. There must be some stability in these relationships. Otherwise, counselling cannot proceed except in a hit or miss fashion.

It was, therefore, decided that for making a comparative study of the relationships between the given test variables and the criterion of success in each of the three courses, the three groups must be equated on the basis of a broad 'reasoning' factor which is known to be significantly related to school success and which in a study of this kind should neither favour the one nor the other at the beginning of the study. The Inductive Reasoning test lent itself as a basis for equating the samples for an additional consideration, namely, that its items were such that they did not favour pupils in any of the three courses.

The method adopted for equating the three samples was to take the pupils from the three courses who secured common scores. The frequencies for each score for the three groups were plotted and the smallest number of frequencies for each unit score in whichever group they occurred were accepted. After the frequencies for each score were thus determined, the investigator, starting from the beginning of the list, included all those students in the sample which had those scores, until the requisite number for each score was obtained. In all, 180 pupils were obtained for each sample. Table 6·2 gives the frequency distribution of the scores of the equated samples.

TABLE 6·2

Frequency Distribution of the Inductive Reasoning Test Scores for the Equated Samples

Score	Frequency
40—43	2
36—39	4
32—35	11
28—31	17
24—27	27
20—23	39
16—19	27
12—15	18
8—11	9
4— 7	14
0— 3	12
	N=180

It would be interesting to compare the distribution of scores of the equated samples (N=180 each) with that of the total sample (N=1104). Figures 6·2 and 6·3 represent graphically the frequency distributions of scores on Inductive Reasoning test for the total group and the equated samples, respectively. (See pp. 40-41). It will be seen that the bunching of scores on the lower end in the total group has been considerably reduced in the equated sample; the variability too is slightly reduced, but the mean value does not seem to have changed. Moreover, the essential shape of the two distributions remains more or less the same.

The means and standard deviations for the two groups besides those for the original Science, Arts, and Commerce groups were calculated. Table 6·3 provides these statistics.

TABLE 6·3

Means and Standard Deviations of Scores of the Total Group, The Three Groups Taken Separately, and the Equated Sample, on the Inductive Reasoning Test

Group	N	Mean	Standard Deviation
Total Group	1,104	19·05	11·22
Science Group	364	24·73	10·47
Arts Group	326	15·28	10·38
Commerce Group	414	17·04	10·56
Equated Sample	180 (in each group)	19·73	9·43

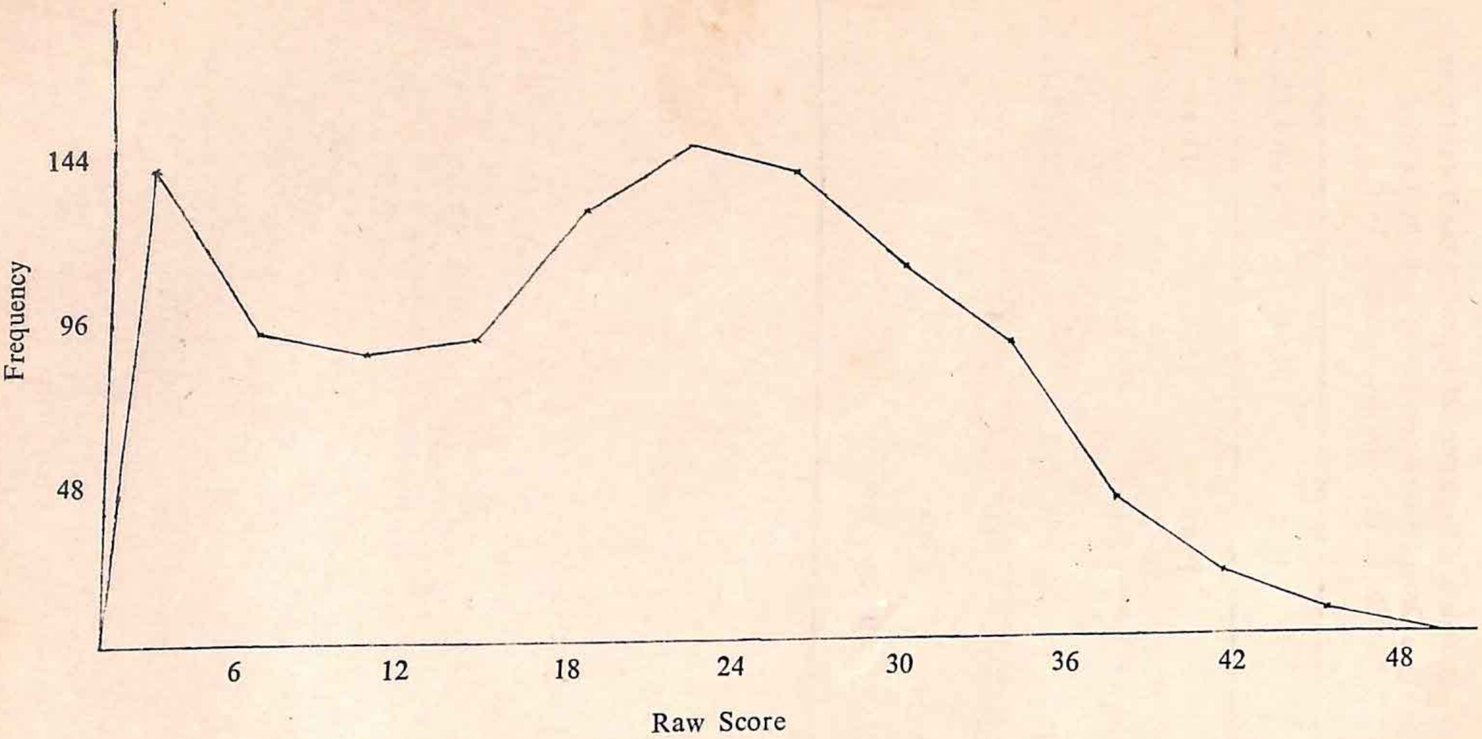


Figure 6·2 A frequncy polygon for the distribution of score on the Inductive Reasoning test for the total sample (N=1104).

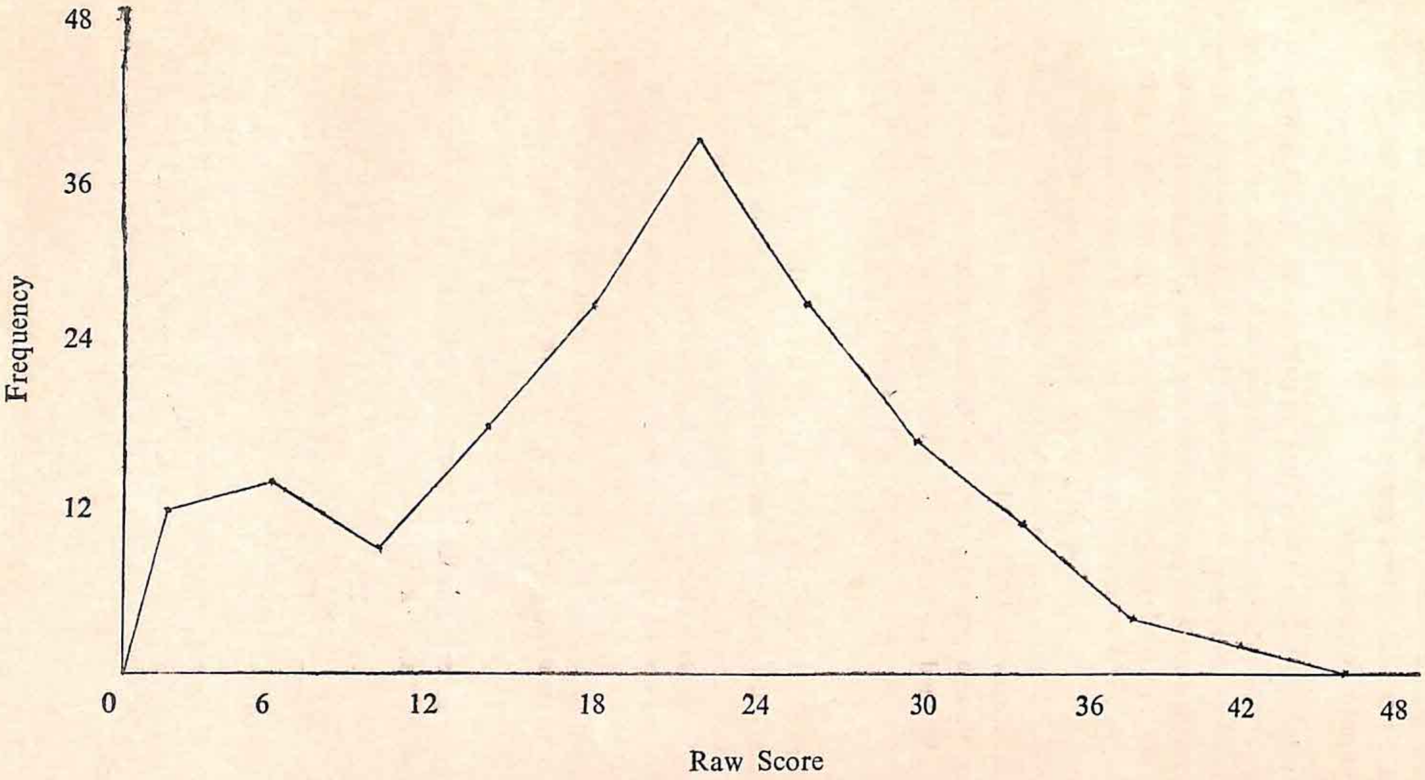


Figure 6·3 A frequency polygon for the distribution of scores on the Inductive Reasoning Test for the equated sample (N=180).

III. Intercorrelations Among Test Variables

The total number of Pearson product moment coefficients of correlation computed were 45 for the Science group, 36 for the Arts group and 36 for the Commerce group. These were later checked on the electronic computer for accuracy.

It may be pointed out here that in calculating the r's it was not considered necessary to spend time on testing each relationship among test variables, and between the test variables and the criterion, for linearity, as further analysis of the same data was to be resorted to with the use of biserial r and analysis of variance statistics which were to provide the basis for final interpretation of results. The product moment r's were intended to provide a general picture of intercorrelations among test variables and correlations of test variables with the criterion of composite scores in major subjects, at the end of grade IX only. This, it was thought, would help in making a comparative study of the results obtained on the basis of two types of criteria, namely, composite score in major subjects and pass-fail at the end of grade IX.

Guilford (1956) has indicated that it is not that the Pearson r is to be computed only with normal distributions. "The forms of distribution may be various ; so long as they are fairly symmetrical and unimodal, even rectangular ones will do." (p. 150). A study of frequency distributions of various scores (see Appendix B, Tables IV through XVI) shows that except for the Spatial Visualization test for which the distribution is positively skewed (mainly because all minus scores have been treated as zero) other tests are showing fairly symmetrical distributions.

Table 6·4 gives the intercorrelation coefficients of the tests based on the following N's :

Science — 175
Art — 173
Commerce — 173

These N's represent the numbers of pupils from the equated samples for whom the criterion data at the end of grade IX was also available.

TABLE 6·4

Intercorrelations of Test Variables Shown Separately for Each Group

Variables	Groups			Significance of difference
	Science	Arts	Commerce	
Verbal Facility—Numerical Facility	·159	·270	·031	Significant at 5% level
Verbal Facility—Verbal Meaning	·297	·348	·188	
Verbal Facility—Inductive Reasoning	·305	·204	·220	
Verbal Facility—Mechanical Reasoning	·260	·243	·099	
Verbal Facility—Perceptual Speed	·200	·273	·205	
Verbal Facility—Rote Memory	·056	·245	·037	
Verbal Facility—Spatial Visualization	·182	·113	·022	
Verbal Facility—Study Habits	·146	·099	·066	
Verbal Facility—Interest in Science	·103	—	—	
Numerical Facility—Verbal Meaning	·057	·260	·034	5% level
Numerical Facility—Inductive Reasoning	·179	·272	·183	
Numerical Facility—Mechanical Reasoning	·109	·142	·011	

Note : Pairs of coefficients of correlation which differ significantly at ·05 level have been underlined, those which differ at ·01 level have been starred.

TABLE 6·4 (Continued)

Varinbles	Groups			Significance of difference
	Science	Arts	Commerce	
Numerical Facility—Perceptual Speed	·255	·455	·385	
Numerical Facility—Rote Memory	·053	·271	·107	5% level
Numerical Facility—Spatial Visualization	—·050	—·001	·061	
Numerical Facility—Study Habits	·162	·144	·059	
Numerical Facility—Interest in Science	—·036	—	—	
Verbal Meaning—Inductive Reasoning	·310	·283	·325	
Verbal Meaning—Mechanical Reasoning	·225	·238	·222	
Verbal Meaning—Perceptual Speed	·138	·249	·257	
Verbal Meaning—Rote Memory	—·014	·201	·127	5% level
Verbal Meaning—Spatial Visualization	·246	·150	·155	
Verbal Meaning—Study Habits	·080	·107	·007	
Verbal Meaning—Interest in Science	·189	—	—	
Inductive Reasoning—Mechanical Reasoning	·257	·346	·194	
Inductive Reasoning—Perceptual Speed	·182	·315	·324	

TABLE 6·4 (Continued)

Variables	Groups			Significance of difference
	Science	Arts	Commerce	
Inductive Reasoning—Rote Memory	·309	·088	·093	5% level
Inductive Reasoning—Spatial Visualization	·332	·194	·253	
Inductive Reasoning—Study Habits	·035	·038	·001	
Inductive Reasoning—Interest in Science	·183	—	—	
Mechanical Reasoning—Perceptual Speed	·166	·207	·150	
Mechanical Reasoning—Rote Memory	·014	·064	·080	
Mechanical Reasoning—Spatial Visualization	·340	·158	·086	5% level
Mechanical Reasoning—Study Habits	·007	—·027	—·004	
Mechanical Reasoning—Interest in Science	·012	—	—	
Perceptual Speed—Rote Memory	·119	·308	·216	
Perceptual Speed—Spatial Visualization	·105	·112	·140	
Perceptual Speed—Study Habits	·165	·262*	—·036*	*1% level
Perceptual Speed—Interest in Science	—·015	—	—	
Rote Memory—Spatial Visualization	—·018	—·081	—·196	

TABLE 6·4 (Continued)

Variables	Groups			Significance of difference
	Science	Arts	Commerce	
Rote Memory— Study Habits	·182*	·095	—·165*	5% level *1% level
Rote Memory— Interest in Science	·103	—	—	
Spatial Visualization— Study Habits	·010	—·033	·080	
Spatial Visualization— Interest in Science	·008	—	—	
Study Habits— Interest in Science	·005	—	—	

Following values give the differences between pairs of correlation coefficients, which are significant at ·05 and ·01 levels respectively.

Difference significant at ·05 level

(i) between Science and Arts ·211

(ii) between Science and Commerce ·211

(iii) between Arts and Commerce ·211

Difference significant at ·01 level

(i) between Science and Arts ·278

(ii) between Science and Commerce ·278

(iii) between Arts and Commerce ·278

The z test of difference between r's was used to determine which pairs of coefficients of correlation were significantly different. (See Guilford : 1956, p. 194).

An examination of the intercorrelation coefficients of the test variables will show that in the majority of cases they do not differ significantly from each other. This is to be expected as the three groups have been equated on the basis of the Inductive Reasoning test which was referred to earlier as coming closest to the measurement of "g" factor. It is well-known that most of the academic aptitude tests show positive intercorrelations because of the presence of the general factor Out of the 108 pairs of correlations on the tests administered to the three groups only nine turned out to be significantly different—seven at ·05 level of signifiance and only two at the ·01 level.

This might be interpreted to mean that so far as these abilities are concerned the three groups are behaving in more or less similar fashion at the beginning of the course. This is of great advantage in making reliable comparisons of pupil performance in the three courses at the end of the three-year period of study.

A second observation that can be made is that the intercorrelations are generally low. The highest intercorrelation obtained is ·455 between the Numerical Facility Test and Perceptual Speed Test for the Arts Group. This is understandable as the two tests have a high variance of speed factor common to them. In general, the tests of the battery which have a common factor of speed involved in them are moderately highly correlated. The second set of tests which are moderately highly correlated consists of the two verbal tests and the test of Inductive Reasoning—the range of correlations in this group being from ·204 between Verbal Facility and Inductive Reasoning to ·348 between Verbal Facility and Verbal Meaning.

As a general observation it may be pointed out here that the tests seem to be measuring more or less independent factors and justify their inclusion in a differential aptitude test battery. The correlations are generally lower than those reported for the Differential Aptitude Tests Battery of the Psychological Corporation. A part of this phenomenon may be attributed to the restriction of ability range imposed by equating the samples.

IV. Correlations with the Composite Score Criterion at the End of Grade IX

It was mentioned earlier that one criterion at the end of grade IX consisted of composite scores in the major subjects of each course. Annual examination marks were collected from each school in different subjects and were converted to standard scores with a mean of 50 and standard deviation of 10 in order to make them comparable from one school to another. Standard scores of the appropriate subjects were then added together to form the criterion score. Pearson r's were computed between each independent variable and the criterion. Table 6·5 gives the zero order correlations between the independent variables and the criterion in each course.

TABLE 6·5

Zero Order Correlations Between Test Variables and the Criterion in Each Course

Variable	Correlation with the Criterion		
	Science N = 175	Arts N = 173	Commerce N = 173
Verbal Facility	·090	·261**	·071
Numerical Facility	·215**	·331**	·278**
Verbal Meaning	·234**	·487**	·270**
Inductive Reasoning	·336**	·241**	·243**
Mechanical Reasoning	·187*	·207**	·067
Perceptual Speed	·136	·290**	·232**
Rote Memory	·209**	·194*	·182*
Spatial Visualization	·089	·066	·105
Study Habits	·047	·164*	·028
Interest in Science	·119	—	—

Values of r at 5% level of significance

(i) Science	·148
(ii) Arts	·149
(iii) Commerce	·149

Values of r at 1% level of significance

(i) Science	·195
(ii) Arts	·197
(iii) Commerce	·197

A close observation of these r's leads to interesting conclusions. We will discuss them separately for each group.

1. *Science.* Out of the ten tests used for this course only five show significant relationship with the criterion. Among them four, namely, Inductive Reasoning, Verbal Meaning, Numerical Facility, and Rote Memory, in the order listed, are significantly related to the criterion beyond ·01 level of significance, and one, namely, Mechanical Reasoning, is significantly related to the criterion at ·05 level of significance. The picture presented is exactly what one would expect.

It is interesting to note that neither Study Habits nor Interest Test scores correlate significantly with success in the Science course. The coefficients of correlation of Interest Test and Study Habits with the criterion are ·119 and ·047, respectively. The correlation of these tests with the other variables is also low which, however, is understandable. But the reasons for these two tests not correlating significantly with the criterion may lie as usual in the rather low reliability of test scores on such variables. As mentioned earlier, inventory types of measures in education and psychology have yet to reach the level of objectivity in respect of both standardization and validation that mental tests have long been credited with. They may also lie in the fact that interests and study habits as tested by these measures are not usually reflected in the examination marks which are notoriously determined to a large measure by the extra effort put in by the examinees during the last one or two months of the school session. Neither lack of interest nor poor study habits would seem to deter pupils from working hard at the time of the examination in an effort to somehow score the pass percentage. School performance over a longer period of time during the entire school session might lead to better results. This, however, is only a hypothesis which needs to be tested.

2. *Arts.* Out of the nine tests used for this course eight show significant relationship with the criterion. Among them six, namely, Verbal Meaning, Numerical Facility, Perceptual Speed, Verbal Facility, Inductive Reasoning, and Mechanical Reasoning, in the order listed, are significantly related with the criterion beyond ·01 level of significance, and two, namely, Rote Memory and Study Habits, are significantly related to the criterion at ·05 level of significance.

As will be seen, the highest single correlation is ·407 with the Verbal Meaning test which is exactly what one would expect. The next three tests are all having a high speed factor common in them. The second place secured by the Numerical Facility test which also measures an aspect of reasoning factor important in school work besides the speed factor is also quite understandable. Inductive Reasoning which may be said to measure also an aspect of pure general reasoning factor takes the fifth place, in a sense the third place if the three tests just mentioned are grouped as speed tests. The emergence of Mechanical Reasoning test immediately following the Inductive Reasoning test leads one to think that in the present context its significance is more the result of a general reasoning factor present in it than of the mechanical ability factor as such. Rote Memory and Study Habits also show up among the significant variables but only at ·05 level of significance. The presence of the Study Habits factor in the Arts group, especially when it is found to be absent in the Science and Commerce groups, may be a chance phenomenon, or else may be the result of special instructions of teachers to Arts students in general to be regular and more careful about their school work. The highest percentage of failure, as is well known, is in the Arts course, and both the headmaster and the teacher are always worried about it.

3. *Commerce*—Out of the nine tests used for this course only five show significant relationship with the criterion. Among them four, namely, Numerical Facility, Verbal Meaning, Inductive Reasoning, and Perceptual Speed, in the order listed, are significantly related to the criterion beyond ·01 level of significance, and only one, namely, Rote Memory, is significantly related to the criterion beyond ·05 level of significance. Here too the picture is pretty clear and one that would be generally expected.

When a totality view of these correlations is taken certain facts stand out very clearly :

1. The highest single correlation is for Arts followed by Science and Commerce, which suggests that better prediction is possible for those subject areas with which the pupils have had longer familiarity.

2. The order in which the variables appear for the three courses is different. Each one has its own unique pattern of abilities required for success. Thus the best single predictor for the Science course is the Inductive Reasoning test followed by Verbal Meaning and Numerical Facility tests. For the Arts and Commerce courses, however, Verbal Meaning and Numerical Facility tests prove to be the most important ones.

3. The number of factors required for success in the three courses may also vary.

We will follow up these conclusions at the end of grades X and XI and will reserve our comments until then. The picture is, however, encouraging and is in line with our original hypothesis.

V. Computation of Multiple R's.

Significant correlations between the test variables and the criterion in each case were selected for further study by means of multiple correlation technique. As stated by Guilford (1956) : "When we are interested in the amount of correlation between a dependent variable and two or more others simultaneously we are dealing with a multiple correlation problem." (p. 392). Aitken's method of pivotal condensation was used. The main interest in this study was to find out the beta coefficiants. Incidentally, it may be noted here that in calculating the multiple R theoretically those items are chosen in combination that have the highest correlation with the criterion and yet show a low correlation with each other.

Table 6.6 shows the test variables selected for computing the multiple R's for each curricular group together with the correlations with the criterion and the intercorrelations of the tests selected.

TABLE 6 6

Tests Selected for Computing the Multiple R's for the Three Groups, Their Inter-Correlations and Correlation with the Criterion

Group	Variable	Correlation with the Criterion	Intercorrelation 1	2	3	4
Science	1. Inductive Reasoning	·336	·310	·179	·309	·257
	2. Verbal Meaning	·234		·057	—·014	·225
	3. Numerical Facility	·215			·053	·109
	4, Rote Memory	·209				·014
	5. Mechanical Reasoning	·187				
Arts	1. Verbal Meaning	·487	·260	·249	·348	·283
	2. Numerical Facility	·331		·455	·270	·272
	3. Perceptual Speed	·290			·273	·315
	4. Number Facility	·261				·204
	5. Inductive Reasoning	·241				
Commerce	1. Numerical Facility	·278	·034	·183	·385	·107
	2. Verbal Meaning	·270		·325	·257	·127
	3. Inductive Reasoning	·243			·324	·093
	4. Perceptual Speed	·232				·216

Table 6.7 through 6·9 give multiple correlations of two, three, and four independent variables with the criterion for the three groups including the multiple R's and the beta coefficients.

TABLE 6.7

Multiple Correlations of Two, Three, and Four Independent Variables with the Criterion for the *Science Group* Including Multiple Correlation Coefficients (R's) and Beta Coefficients

Column I	Column II	Column III	Column IV
	Values derived from 2 measures (Col. I a, b)	Values derived from 3 measures (Col. I a, b, c)	Values derived from 4 measures (Col. I a, b, c, d)
Variable Combinations	Beta Coeff.	Beta Coeff.	Beta Coeff.
a. Inductive Reasoning	·292	·263	·216
b. Verbal Meaning	·144	·141	·158
c. Numerical Facility		·160	·160
d. Rote Memory			·136
Multiple R	·363*	·394*	·415

* Increase significant at ·05 level.

TABLE 6·8

Multiple Correlations of Two, Three, and Four Independent Variables with the Criterion for the *Arts Group* Including Multiple Correlation Coefficients (R's) and Beta Coefficients

Column I	Column II	Column III	Column IV
	Values derived from 2 measures (Col. I a, b)	Values derived from 3 measures (Col. I a, b, c)	Values derived from 4 measures (Col. I a, b, c, d)
Variable Combinations	Beta Coeff.	Beta Coeff.	Beta Coeff.
a. Verbal Meaning	·430	·415	·401
b. Numerical Facility	·219	·174	·167
c. Perceptual Speed		·108	·101
d. Verbal Facility			·050
Multiple R	·531*	·539	·541

* Increase significant at ·01 level.

TABLE 6·9

Multiple Correlations of Two, Three, and Four Independent Variables with the Criterion for the *Commerce Group* Including Multiple Correlation Coefficients (R's) and Beta Coefficients

Column I Variable Combinations	Column II Values derived from 2 measures (Col. I a, b) Beta Coeff.	Column III Values derived from 3 measures (Col. I a, b, c) Beta Coeff.	Column IV Values derived from 4 measures (Col. I a, b, c, d) Beta Coeff.
a. Numerical Facility	·269	·247	·229
b. Verbal Meaning	·261	·221	·212
c. Inductive Reasoning		·126	·116
d. Perceptual Speed			·052
Multiple R	·381*	·399	·401

* Increase significant at ·01 level.

What has been attempted here is to find out whether the multiple R with more independent variables included is significantly greater than the R with a smaller number of variables. For an insignificant gain it is obviously uneconomical to add more variables, although by themselves the additional variables may be significantly related to the criterion. There is available an F test for finding out whether the gain due to an additional test is significant.

It will be seen that so far as the Science course is concerned a combination of three tests, namely, Inductive Reasoning, Verbal Meaning, and Numerical Facility, gives a maximum correlation of ·394. The increase in correlation from ·336 (Inductive Reasoning with the criterion) to ·363 and from ·363 to ·394 obtained by adding the Verbal Meaning and Numerical facility tests respectively is significant at ·05 level of significance. With the addition of the Rote Memory test the correlation increases to a level of ·415. This increase is not significant.

In the case of Arts the only additional test which significantly adds to the correlation obtained by using the Verbal Meaning test alone (·487) is the Numerical Facility test which raises the multiple correlation to ·531. This increase is significant beyond ·01 level of significance. Beyond this the addition of other tests does not significantly raise the multiple R. We would do well to use these two tests alone for the sake of economy, as with the addition of two more tests, namely, Perceptual Speed and Verbal Facility the multiple R is raised by ·01 only. It will be recalled that these two tests are also measuring to a considerable degree a common speed factor which the Numerical Facility test also measures. Hence no significant increase in the multiple R over and above the Numerical Facility test should be expected.

As for the Commerce course, again a combination of two tests, namely, Numerical Facility, and Verbal Meaning, gives a multiple R of ·381 which with the addition of other tests is not significantly increased.

A study of the beta weights of the independent variables in the significant combinations reveals the following :

In the Science course the Inductive Reasoning test has twice as much weight as the Verbal Meaning and about one and a half times as much as the Numerical Facility test. In the Arts course the Verbal Meaning test takes precedence over every other test. The beta weight for this test is twice as much as that for the Numerical Facility test. In the Commerce course the beta weights show that both the Numerical Facility test and the Verbal Meaning test are equally important.

Regarding the number of tests in the significant combinations it may be noted here that the present research seems to be quite in agreement with previous research (Garrett : 1949) as to the fact that the addition of a third or fourth variable in the computing of R produces such a small increase in the size of R that it is hardly worth the effort to include them.

VI. Use of Biserial r's and Analysis of Variance

A further analysis of the data at the end of grade IX was carried out by using the pass-fail criterion.

Table 6·10 gives the number of students in each course who passed at the end of grade IX and of those who failed.

TABLE 6·10

Number of Students Who Passed, Failed, or Were Missing at the End of Grade IX

Group	Number of Students			
	Passed	Failed	Missing*	Total
Science	121	54	5	180
Arts	108	65	7	180
Commerce	110	63	7	180

*Students who either left the school or were sick at the time o the examination.

Table 6·11 gives the biserial r's for the three groups.

TABLE 6·11

Biserial r's for the Science, Arts, and Commerce Groups, with the Pass-Fail Criterion at the End of Grade IX

Variable	Biserial r		
	Science	Arts	Commerce
Verbal Facility	·07	·21*	·13
Numerical Facility	·24*	·33**	·23*
Verbal Meaning	·23*	·47**	·38**
Inductive Reasoning	·26**	·31**	·27**
Mechanical Reasoning	·14	·22*	·09
Perceptual Speed	·04	·23*	·20*
Rote Memory	·11	·12	·10
Spatial Visualization	—·12	·11	·13
Study Habits	·05	·10	·07

** r's significant at ·01 level

* r's significant at ·05 level

A comparison of correlations between test variables and the criterion when two different criteria (composite score in major subjects and pass-fail) are used is of some interest The following points may be noted.

1. The best predictors for each of the three courses remain practically the same. Thus Inductive Reasoning test is again the best predictor for the Science course and Verbal Meaning the best predictor for the Arts and Commerce courses. It may be pointed out that although the correlation of Numerical Facility test with the composite score criterion for the Commerce course (·278) was slightly better than that with the Verbal Meaning test (·270), the difference was not significant.

2. Memory and Study Habits no longer appear as significant variables for the three courses. The other variables with the exception of Mechanical Reasoning which does not appear now as significant for the Science course maintain their positions.

It is interesting to note, however, that there is no major change in the factor patterns for the three courses when the criterion is changed from composite score in major subjects to a pass-fail criterion which includes all the subjects. This is due to the fact that success in the three courses depends mainly on successful performance in major subjects. Of the five correlations that have not appeared with the use of pass-fail criterion four were significant only at ·05 level of significance when the composite scrore criterion was used. (See Table 6·5).

Analysis of Variance

With a view to verifying the results obtained, and considering the usefulness of the technique of analysis of variance for differential prediction studies, the investigator decided to submit the present data for further statistical analysis. Moreover, he wanted to study the difference between the means of successful candidates in the three groups with a view to ascertaining the extent of the likeness and differences which might characterize successful pupils in the three courses.

Tables 6·12 through 6·14 give the means and variances of the successful and unsuccessful candidates in the three groups.

TABLE 6·12

Means and Variances of Successful and Unsuccessful Candidates in the *Science Course* for the Nine Independent Variables at the End of Grade IX

		Variable								
Science Group		X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
Successful	M	29·07	50·66	35·03	21·15	14·68	31·54	13·02	12·23	42·98
N=121	V	52·10	61·32	146·09	88·84	57·52	51·70	27·78	105·65	122·35
Unsuccessful	M	28·22	47·35	30·43	17·11	13·00	31·05	12·11	14·24	42·13
N=54	V	80·10	77·55	126·78	82·86	51·47	52·62	20·36	135 09	71·28

TABLE 6·13

Means and Variance of Successful and Unsuccessful Candidates in the *Arts Course* for the Nine Independent Variables at the End of Grade IX

Arts Group		Variable								
		X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
Successful	M	27·21	50·11	33·55	21·31	12·99	30·68	11·76	12·24	40·55
N=65	V	45·96	63·11	115·84	86·85	48·89	67·22	22·31	86·03	100·36
Unsuccessful	M	24·91	45·51	25·32	16·69	10·52	27·78	10·81	10·68	38·94
N=108	V	48·08	76·97	78·06	75·75	47·51	54·52	26·75	73·97	86·37

TABLE 6.14

Means and Variances of Successful and Unsuccessful Candidates in the *Commerce Course* for the Nine Independent Variables at the End of Grade IX

		Variable								
Commerce Group		X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
Successful	M	25·90	51·93	33·17	21·09	11·52	31·89	12·02	11·51	41·19
N=110	V	51·76	52·78	98·29	94.80	45.30	69·42	20·49	83·33	91·39
Unsuccessful	M	24·29	49·21	26·90	16·95	10·16	29·29	11·25	9·51	40·06
N=63	V	60·34	55·28	82·18	70·92	41.29	45·69	20·74	89·64	106·35

X_1 — Verbal Facility
X_2 — Numerical Facility
X_3 — Verbal Meaning
X_4 — Inductive Reasoning
X_5 — Mechanical Reasoning
X_6 — Perceptual Speed
X_7 — Rote Memory
X_8 — Spatial Visualization
X_9 — Study Habits
X_{10} — Interest in Science

Note : Wherever these notations are used in this report they refer to the above variables.

Tables 6·15 through 6·17 give the results of the analysis of variance.

TABLE 6·15

Results of Analysis of Variance Involving Successful and Unsuccessf Candidates in the *Science Course* on the Nine Independent Variables at the End of Grade IX (N=175)

X_1

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	27·10	1	27·10
Within Sets	10497·68	173	60·68
Total ...	10524·75	174	

F=·45 N.S.

X_2

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	408·89	1	408·89
Within Sets	11469·43	173	66·29
Total ...	11878·32	174	

F=6·17 Significant beyond ·05 level

X_3

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	792·50	1	792·50
Within Sets	24251·08	173	140·18
Total ...	25043·58	174	

F=5·65 Significant beyond ·05 level

TABLE 6·15 (Continued)

X_4

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	608·70	1	608·70
Within Sets	15052·65	173	87·01
Total	... 15661·35	174	

F=6·99 Significant at ·01 level

X_5

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	105·09	1	105·09
Within Sets	9630·43	173	55·67
Total	... 9735·52	174	

F=1·89 N.S.

X_6

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	8·96	1	8·96
Within Sets	9204·84	173	53·20
Total	... 9213·80	174	

F=·17 N S.

TABLE 6·15 (Continued)

X_7

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	30·61	1	30·61
Within Sets	4413·30	173	25·51
Total ...	4443·91	174	

F=1·20 N.S.

X_8

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	150·75	1	150·75
Within Sets	19837·39	173	114·67
Total ...	19988·14	174	

F=1·31 N.S.

X_9

Components	Sum of Squares	Degress of freedom	Variance
Between Sets	27·21	1	27·21
Within Sets	18460·07	173	106·70
Total ...	18487·28	174	

F=·25 N.S.

TABLE 6·16

Results of Analysis of Variance Involving Successful and Unsuccessful Candidates in the *Arts Course* on the Nine Independent Variables at the End of Grade IX (N=173)

X_1

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	215·65	1	215·65
Within Sets	7995·55	171	46·75
Total ...	8211·20	172	

F=4·61 Significant at ·05 level

X_2

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	859·91	1	859·91
Within Sets	11678·92	171	68·29
Total ...	12538·83	172	

F=12·59 Significant beyond ·01 level

X_3

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	2750·12	1	2750·12
Within Sets	17390·89	171	101·70
Total ...	20141·01	172	

F=27·04 Highly Significant

TABLE 6·16 (Continued)

X_4

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	863·58	1	863·58
Within Sets	14140·70	171	82·70
Total ...	15004·28	172	

F=10·44 Highly Significant

X_5

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	247·10	1	247·10
Within Sets	8179·31	171	47·83
Total ...	8426·21	172	

F=5·17 Significant beyond ·05 level

X_6

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	341·39	1	341·39
Within Sets	10146·29	171	59·33
Total ...	10487·68	172	

F=5·75 Significant beyond ·05 level

TABLE 6.16 (Continued)

X_7

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	36·87	1	36·87
Within Sets	4098·99	171	23·90
Total ...	4135·86	172	

F = 1·54 N. S.

X_8

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	99·24	1	99·24
Within Sets	13939·96	171	81·50
Total ...	14039·20	172	

F = 1·22 N. S.

X_9

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	104·90	1	104.90
Within Sets	16266·53	171	95·12
Total ...	16371·43	172	

F = 1·10 N. S.

TABLE 6·17

Results of Analysis of Variance Involving Successful and Unsuccessful Candidates in the *Commerce Course* on the Nine Independent Variables at the End of Grade IX (N=173)

X_1

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	104·39	1	104·39
Within Sets	9382·76	171	54·87
Total ...	9487·15	172	

F=1·90 N.S.

X_2

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	298·55	1	298·55
Within Sets	9179·88	171	53·68
Total ...	9478·43	172	

F=5·56 Significant beyond ·05 level

X_3

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	1573·77	1	1573·77
Within Sets	15809·15	171	92·45
Total ...	17382·92	172	

F=17·02 Highly Significant

TABLE 6.17 (Continued)

X_4

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	686·09	1	686·09
Within Sets	14729·95	171	86·14
Total ...	15416·04	172	

F=7·96 Significant at ·01 level

X_5

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	74·04	1	74·04
Within Sets	7497·87	171	43·80
Total ...	7571·91	172	

F=1·69 N. S.

X_6

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	271·87	1	271·87
Within Sets	10399·56	171	60·81
Total ...	10671·43	172	

F=4.47 Singnificant beyond ·05 level

TABLE 6·17 (Continued)

X_7

Components	Sum of Squares	Degree of freedom	Variance
Between Sets	23·39	1	23·39
Within Sets	3519·90	171	20·58
Total ...	3543·29	172	

F=1·14 N.S.

X_8

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	160·41	1	160·41
Within Sets	14641·24	171	85·62
Total ...	14801·65	172	

F=1·87 N.S.

X_9

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	50·91	1	50·91
Within Sets	16554·75	171	96·81
Total ...	16605·66	172	

F=·53 N.S.

It will be seen that this analysis yields exacty the same results as obtained through the computation of biserial r's.

VII. Analysis of Data at the End of Grade X

Since the ultimate purpose of the study was to arrive at conclusions at the end of grade XI (the final year of the higher secondary course) it was considered desirable to analyze the data obtained at the end of grade X in terms of the pass-fail criterion. The final examination at grade X is much stiffer than that at grade IX bacause the schools are concerned at this stage with screening out those candidates who are not a good risk for a public examination at the end of grade XI. They thoroughly weigh and balance their material, as it were, before they want it to be handed over to others to be judged.

The reason for using the pass-fail criterion as indicated earlier was that in this way alone the earlier IX grade failures could be included in the analysis of results. The statistic used to study the relationship between the test variables and the criterion of success at the end of grade X was, therefore, the biserial r. It may be noted here that the curricular courses in grade X become more and more biased toward the major subjects of each group and hence the total result indicating 'pass' or 'fail' is a reasonable criterion to adopt.

Table 6·18 gives the number of students in each course who had passed at the end of grade X, and of those who had failed either in grade IX or grade X, and who were missing.

TABLE 6·18

Number of Students Who had Passed, Failed, or Were Missing at the End of Grade X

Group	Number of Students			Total
	Passed	Failed	Missing*	
Science	91	79	10	180
Arts	79	91	10	180
Commerce	88	80	12	180

*Students who had either left the school or were sick at the time of the examination.

Table 6·19 gives the biserial r's for the three groups.

TABLE 6·19

Biserial r's for the Science, Arts, and Commerce Groups, with the Pass-Fail Criterion at the End of Grade X

Variable	Biserial r		
	Science	Arts	Commerce
Verbal Facility	·06	·28**	·18
Numerical Facility	·15	·26**	·21*
Verbal Meaning	·16	·43**	·40**
Inductive Reasoning	·38**	·29**	·21*
Mechanical Reasoning	·13	·22*	·06
Perceptual Speed	·09	·21*	·18
Rote Memory	·24**	·06	·18
Spatial Visualization	·004	·008	·15
Study Habits	·08	·10	·12

** r's significant at ·01 level

* r's significant at ·05 level

The correlations reveal some interesting facts especially when compared with the correlations obtained for the pass-fail criterion at the end of grade IX.

1. The best single predictors in the three courses still remain practically the same. Thus while Inductive Reasoning is the best single predictor for the Science course, Verbal Meaning continues to be strongly related to Arts and Commerce courses.

2. Numerical Facility and Inductive Reasoning continue to remain significant beyound ·01 level of significance for the Arts course. Verbal Facility too has reached ·01 level of significance.

3. Speaking of the Science course, Numerical Facility and Verbal Meaning which were significant at ·05 level of significance at the end of grade IX no longer appear to be significant, although they still reach very close to the ·05 level of significance. Their absence at this stage may be due to certain chance factors which might have operated at the time of the examination, or due to some other factors involved in evaluation. These same reasons, and some others, might have caused the emergence of Rote Memory as a significant variable for this course at this stage.

There is nothing special to be noted with regard to the Commerce course.

Analysis of Variance

Tables 6.20 through 6.22 give the means and variances of the successful and unsuccessful candidates in the three courses.

Tables 6·23 through 6·25 give the results of the Analysis of Variance.

TABLE 6·23

Results of Analysis of Variance Involving Successful and Unsuccessful Candidates in the *Science Course* on the Nine Independent Variables at the End of Grade X (N=170)

X_1

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	26·89	1	26·89
Within Sets	10347·16	168	61·59
Total ...	10374·05	169	

$$F=\frac{26{\cdot}89}{61{\cdot}59}={\cdot}44 \text{ N. S.}$$

X_2

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	167·20	1	167·20
Within Sets	11127·91	168	66·24
Total ...	11295·11	169	

$F=2{\cdot}5$ N.S.

X_3

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	405·82	1	405·82
Within Sets	23263·36	168	138·47
Total ...	23669·18	169	

$F=2{\cdot}93$ N. S.

TABLE 6·23 (Continued)

X_4

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	1395·36	1	1395·36
Within Sets	14148·69	168	84·22
Total ...	15544·05	169	

F=16·57 Highly Significant.

X_5

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	106·49	1	106·49
Within Sets	9467·80	168	56·36
Total ...	9574·29	169	

F=1·89 Highly Significant.

X_6

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	40·70	1	40·70
Within Sets	8778·69	168	52·25
Total ...	8819·39	169	

F=·78 N. S.

TABLE 6·23 (Continued)

X_7

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	1155·69	1	155·69
Within Sets	4140·33	168	24·64
Total ...	4296·02	169	

F=6·32 Significant at ·05 level

X_8

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	·32	1	·32
Within Sets	19512·27	168	116·14
Total ...	19512·59	169	

F=·002 N.S.

X_9

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	70·65	1	70·65
Within Sets	18152·06	168	108·05
Total ...	18222·71	169	

F=·65 N. S.

TABLE 6·24

Results of Analysis of Variance Involving Successful and Unsuccessful Candidates in the *Arts Course* on the Nine Independent Variables at the End of Grade X (N=170)

X_1

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	407·43	1	407·43
Within Sets	7772·48	168	46·26
Total ...	8179·91	169	

F=8·81 Significant beyond ·01 level

X_2

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	525·32	1	525·32
Within Sets	11968·89	168	71·24
Total ...	12494·21	169	

F=7·4 Significant beyond ·01 level

X_3

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	2340·00	1	2340·00
Within Sets	17648·48	168	105·05
Total ...	19988·48	169	

F=22·27 Highly Significant

TABLE 6·24 (Continued)

X_4

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	832·34	1	832·34
Within Sets	14405·45	168	85·75
Total ...	15237·79	169	

F=9·71 Highly Significant.

X_5

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	249·09	1	249·09
Within Sets	7135·00	168	42·47
Total ...	7384·09	169	

F=5·87 Significant beyond .05 level.

X_6

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	280·92	1	280·92
Within Sets	9784·43	168	58·24
Total ...	10065·39	169	

F=4·82 Significant at .05 level.

TABLE 6·24 (Continued)

X_7

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	9·50	1	9·50
Within Sets	4030·71	168	23·99
Total ...	4040·21	169	

F = ·4 N. S.

X_8

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	·62	1	·62
Within Sets	13922·76	168	82·87
Total ...	13923·38	169	

F = ·007 N. S.

X_9

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	112·63	1	112·63
Within Sets	16120·76	168	95·96
Total ...	16233·39	169	

F = 1·17 N. S.

TABLE 6·25

Results of Analysis of Variance Involving Successful and Unsuccessful Candidates in the *Commerce Course* on the Nine Independent Variables at the End of Grade X (N=168)

X_1

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	191·87	1	199·87
Within Sets	8559·84	166	51·57
Total ...	8751·71	167	

F=3·72 N. S.

X_2

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	278·34	1	278·34
Within Sets	9188·03	166	55·35
Total ...	9466·37	167	

F=5·03 Significant at ·05 level.

X_3

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	1797·82	1	1797·82
Within Sets	15263·17	166	91·95
Total ...	17060·99	167	

F=19·55 Highly Significant.

TABLE 6.25 (Continued)

X_4

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	417·60	1	417·60
Within Sets	14673·04	166	88·39
Total ...	15090·64	167	

F=4·72 Significant beyond ·05 level

X_5

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	18·97	1	18·97
Within Sets	7204·15	166	43·40
Total ...	7223·12	167	

F=3·44 N. S.

X_6

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	214·08	1	214·08
Within Sets	10334·44	166	62·26
Total ..	10548·52	167	

F=3.44 N. S.

TABLE 6 25 (Continued)

X_7

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	76·11	1	76·11
Within Sets	3422·88	166	20·62
Total ...	3498·99	167	

F=3·69 N. S.

X_8

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	204·08	1	204·08
Within Sets	13975·04	166	84·19
Total ...	14179·12	167	

F=2·42 N. S.

X_9

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	149·28	1	149 28
Within Sets	15724·00	166	94·72
Total ...	15873·28	167	

F=1·58 N. S.

It will again be seen that this analysis yields exactly the same results as obtained through the computation of biserial r's. As mentioned earlier, it was resorted to mainly for confirmation of results.

VIII. Analysis of Data at the End of Grade XI.

The same procedure as for grade X was followed.

Table 6.26 gives the number of students in each course who had passed at the end of grade XI, and of those who had failed either in grade IX, X or xi, and who were missing.

TABLE 6·26

Number of Students Who had Passed, Failed, or Were Missing at the End of Grade XI

Group	Number of Students			Total
	Passed	Failed	Missing*	
Science	77	83	20	180
Arts	58	98	24	180
Commerce	76	86	18	180

*Students who had either left the school or were sick at the time of the ennual examination.

Table 6·27 gives the biserial r's for the three groups.

TABLE 6·27

Biserial r's for the Science, Arts, and Commerce Groups with the Pass-Fail Criterion at the End of Grade XI

Variable	Biserial r		
	Science	Arts	Commerce
Verbal Facility	·12	·41**	·21*
Numerical Facility	·22*	·36**	·17
Verbal Meaning	·32**	·57**	·34**
Inductive Reasoning	·54**	·37**	·14
Mechanical Reasoning	·16	·22*	·06
Perceptual Speed	·14	·41**	·14
Rote Memory	·18	·08	·17
Spatial Visualization	·12	·10	·19
Study Habits	·12	·21*	·17

** r's significant at ·01 level

* r's significant at ·05 level

We have now the final picture before us of the correlations between test variables used and the pass-fail criterion at the end of grades IX, X, and XI. A closer study of these correlations both with regard to magnitude and stability is now in order. Interpretations will be made in the light of the total picture which is provided by Table 6·28.

TABLE 6.28

Significant Correlations Obtained at Different Grade Levels with Pass-Fail as the Criterion.

	Grade					
Variable	IX		X		XI	
	Lavel of significance					
I. Science Group	.05	.01	.05	.01	.05	.01
Verbal Facility						
Numerical Facility	×				×	
Verbal Meaning	×					×
Inductive Reasoning		×		×		×
Mechanical Reasoning						
Perceptual Speed						
Rote Memory				×		
Spatial Visualization						
Study Habits						
II. Arts Group						
Verbal Facility	×			×		×
Numerical Facility		×		×		×
Verbal Meaning		×		×		×
Inductive Reasoning		×		×		×
Mechanical Reasoning	×		×		×	
Perceptual Speed	×		×			×
Rote Memory						
Spetial Visualization						
Study Habits					×	
III. Commerce Group						
Verbal Facility					×	
Numerical Facility	×		×			
Verbal Meaning		×		×		×
Inductive Reasoning		×	×			
Mechanical Reasoning						
Perceptual Speed	×					
Rote Memory						
Spatial Visualization						
Study Habits						

The following conclusions can be drawn.

1. The best single predictors for the three courses continue to be Inductive Reasoning for the Science course and Verbal Meaning for the Arts and Commerce courses. Except for the Commerce course for which there is no improvement over IX grade correlations the best predictors have also gained in magnitude. Thus Inductive Reasoning which had a correlation of ·26 with the Science course at the end of grade IX is now correlated to the extent of .54 with the criterion. Similarly Verbal Meaning which had a correlation of .47 with the Arts course at the end of grade IX now shows a correlation of .57.

2. Numerical Facility and Verbal Meaning have again appeared as significant variables for predicting success in the Science course as they were at the end of grade IX, this time Verbal Meaning being significant at .01 level. A combination of Inductive Reasoning and Verbal Meaning, it seems, will yield as high a correlation as would be expected on the basis of factor-tests.

3. For the Arts course Numerical Facility, Verbal Meaning and Inductive Reasoning have consistently shown a high relationship. The presence of a speed factor is also strongly suggested as Verbal Facility and Perceptual Speed which have a large speed variance in them are also found to be consistently related with success in this course. This is understandable as speed counts a great deal in achieving high scores in essay type examinations of which the Arts course is the best example.

4. So far as the Commerce course is concerned the picture is not very encouraging. Neither with regard to magnitude nor in terms of consistency the correlations show a well-formed pattern. The only thing that can be said about this course is that it is the least predictable course with the use of the present set of tests. Verbal factor alone shows a consistent relationship. Understandably the relationship is not of a very high order. Some of the factors must be operating which further research needs to explore.

Analysis of Variance.

Table 6.29 through 6.31 give the means and variances of the successful and unsuccessful candidates in the three courses.

TABLE 6·29

Means and Variances of Successful and Unsuccessful Candidates in the *Science Course* for the Nine Independent Variables at the End of Grade XI

		Variable								
Science Group		X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
Successful	M	29·64	51·23	36·70	24·38	15·08	32·21	13·52	14 08	43·61
N=77	V	50 60	44·65	129·68	64·94	60·59	52·71	31·17	110·20	127·16
Unsuccessful	M	28·25	48·41	30·59	26·08	13·23	30·51	12·07	12·02	41·58
N=83	V	53·29	77·09	139·73	55·47	48·03	55·23	19·75	119 78	93·23

TABLE 6·30

Means and Variances of Successful and Unsuccessful Candidates in the *Arts Course* for the Nine Independent Variables at the End of Grade XI

		Variables								
Arts Group		X_1	X_2	X_3	X^4	X_5	X_6	X_7	X_8	X_9
Successful	M	29·39	51·66	36 55	22 64	13·50	33·22	11·86	12·43	41·79
N=58	V	30·87	59·77	99 02	85·99	52·39	49·02	22·12	98·60	88·66
Unsuccessful	M	24·72	46·61	26·48	17·06	10·97	28 06	11·23	11·04	38·54
N=98	V	53·29	75·75	92·13	77·93	46·48	59·27	25·89	68·82	97 14

TABLE 6·31

Means and Variances of Successful and Unsuccessful Candidates in the *Commerce Course* for the Nine Independent Variables at the End of Grade XI

		Variable								
Commerce Group		X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
Successful	M	26·58	51·72	33·58	20·64	11·50	31·76	12·38	12·11	42·21
N=76	V	55·31	55·36	108·43	108·82	46·17	57·14	22·75	93·04	92·46
Unsuccessful	M	24·24	49·68	28·09	18·42	10·89	29·97	11·17	9·24	39·52
N=80	V	43·86	54·97	80·96	76·88	43·08	66·36	17·93	79·25	98·70

Tables 6·23 through 6·25 give the results of the Analysis of Variance.

TABLE 6·32

Results of Analysis of Variance Involving Successful and Unsuccessful Candidates in the *Science Course* on the Nine Independent Variables at the End of Grade XI (N=160)

X_1

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	76·44	1	76·44
Within Sets	8215·51	158	51·99
Total ...	8291·95	159	

F=1·47 N. S.

X_2

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	318·55	1	318·55
Within Sets	9715·90	158	61·49
Total ...	10034·85	159	

F=Significant at ·05 level

X_3

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	1491·64	1	1491·64
Within Sets	21314·21	158	134·90
Total ...	22805·85	159	

F=11·05 Significant at ·01 level

TABLE 6·32 (Continued)

X_4

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	2764·61	1	2764·61
Within Sets	11944·49	158	75·59
Total ...	14709·10	159	

F=36·33 Highly Significant

X_5

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	136.55	1	136·55
Within Sets	8544·19	158	54·07
Total ...	8680·74	159	

F=2·5 N. S.

X_6

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	115·67	1	115·67
Within Sets	8535·43	158	54·02
Total ...	8651·10	159	

F=2·14 N. S.

TABLE 6·32 (Continued)

X_7

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	83·64	1	83·64
Within Sets	3988·80	158	25·24
Total ...	4072·44	159	

F = 3·30 N. S.

X_8

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	168·68	1	168·48
Within Sets	18197 49	158	115·17
Total ...	18365·97	159	

F = 1·5 N. S.

X_9

Components	Sum of Squares	Degrees of freedom	Variance
Between Sets	164·8	1	164·8
Within Sets	17309·7	158	109·5
Total ...	17474·5	159	

F = 1·51 N. S.

TABLE 6·33

Results of Analysis of Variance Involving Successful and Unsuccessful Candidates in the *Arts Course* on the Nine Independent Variables at the End of Grade X (N=156)

X_1

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	795·32	1	795·32
Within Sets	6929·45	154	44·99
Total ...	7724·77	155	

F=17·67 Highly Significant

X_2

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	926·57	1	926·57
Within Sets	10754·41	154	69·83
Total ...	11680·98	155	

F=13·27 Highly Significant

X_3

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	3688·86	1	3688·86
Within Sets	14580·84	154	94·68
Total ...	18269·70	155	

F=38·96 Highly Significant

TABLE 6.33 (Continued)

X_4

Components	Sum of SquaresD	egrees of Freedom	Variance
Between Sets	1133·13	1	133·13
Within Sets	12461·04	154	80·91
Total ...	13594·17	155	

F=14·00 Highly Significant

X_5

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	233·33	1	233·33
Within Sets	7495·41	154	48·67
Total ...	7728·74	155	

F=4·77 Significant at ·05 level

X_6

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	971·22	1	971·22
Within Sets	8543·73	154	55·47
Total ...	9514·95	155	

F=17.51 Highly Significant

TABLE 6·33 (Continued)

X_7

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	14·33	1	14·33
Within Sets	3772·51	154	24·50
Total ...	3786·84	155	

F = ·58 N. S.

X_8

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	67·35	1	67·35
Within Sets	12296·73	154	79·84
Total ...	12364·08	155	

F = ·84 N. S.

X_9

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	385·33	1	385·33
Within Sets	14475·92	154	93·99
Total ...	14861·25	155	

F = 4·1 Significant at ·05 level

TABLE 6·34

Results of Analysis of Variance Involving Successful and Unsuccessful Candidates in the *Commerce Course* on the Nine Independent Variables at the End of Grade XI (N=162)

X_1

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	219·92	1	219·92
Within Sets	7876·41	160	49·23
Total ...	8096 33	161	

F=4· 49 Significant at. 05 level

X_2

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	167·44	1	167·44
Within Sets	8824·80	160	55·15
Total ...	8992·24	161	

F=3·03 N. S.

X_3

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	214·21	1	214·21
Within Sets	15013·79	160	93 83
Total ...	15228·00	161	

F=12·94 Significant beyond ·01 level.

TABLE 6·34 (Continued)

X_4

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	199·93	1	199·93
Within Sets	14696·35	160	91·85
Total ...	14896·28	161	

F=2·2 N. S.

X_5

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	14·75	1	14·75
Within Sets	7125·06	160	44·53
Total ...	7139·81	161	

F=·33 N. S.

X_6

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	130·43	1	130·43
Within Sets	9926·64	160	62·04
Total ...	10057·07	161	

F=2·1 N. S.

TABLE 6.34 (Continued)

X_7

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	58·80	1	58 80
Within Sets	3230 32	160	24·49
Total ...	3289·12	161	

F=2·4 N. S.

X_8

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	333·31	1	333·31
Within Sets	13713·81	160	85·71
Total ...	14047·12	161	

F=3·88 N. S.

X_9

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	291·24	1	291.24
Within Sets	15324·20	160	95·77
Total ...	15615·44	161	

F=3·04 N. S.

As will be seen this analysis yields the same results as obtained by computing the biserial r's.

CHAPTER VII

Analysis of Data and Results (II) —Similarities and differences between successful candidates of the three groups

This part relates to the second important aspect of the study, namely, whether there would appear at the end of the course certain recognizable differences between the successful candidates of the three courses. In other words, the question is : Do the successful candidates in the three courses show the same ability patterns or, are there some recognizable differences in these patterns which might help to differentiate them at the beginning of the course ? This is a practical problem with which every guidance worker is confronted at the time of curricular guidance.

The technique employed to study this problem was analysis of variance. Successful candidates of the three groups at the end of grades IX, X, and XI were compared on the independent variables to see which of the variables, if any, differentiated one from another.

But in order to draw any valid conclusions from the differences that might appear on the basis of such a study it was considered essential to know the mean performance of the three equated samples, at the beginning of the course, on the test variables other than Inductive Reasoning on which they had been equated. If significant differences did appear on certain of the variables, it wss essential to bear this in mind when interpreting the differences found at the end of the course.

Table 7·1 gives the means and variances of the three equated samples on the nine independent variables.

TABLE 7·1

Means and Variances of Candidates in the Three Equated Samples on the Nine Independent Variables at the Beginning of Grade IX

		Variables								
Group		X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
Science	M	28·77	49·53	33·64	19·77	14·23	31·33	12·67	12·77	42·23
N=180	V	61·30	67·95	144·01	89·42	55·20	55·01	25·39	112·98	108·90
Arts	M	26·33	48·38	30·56	19·74	12·17	29·65	11·42	11·83	39·86
N=180	V	47·39	72·64	115· 5	88·93	49·22	59·80	24·38	84·33	95·24
Commerce	M	25·28	50.97	31·27	19·79	11·15	31·19	11·74	10·61	40·74
N=180	V	53·64	53·75	104·71	89·37	44·04	62·53	19·85	85·43	93 91

A close study of Table 7·1 will show that the science group is on the whole superior to Arts and Commerce groups in its performance on the different tests with the exception of Numerical Facility test on which the Commerce group performs better. Applying the 't' test for the sigificance of difference between means, it was found that a number of Science means were significantly higher than the Arts and the Commerce means. Table 7·2 gives the complete picture.

It will be seen that the most marked differences between means exist on Verbal Facility and Mechanical Reasoning tests for both the Science-Arts and Science-Commerce pairs. These two tests if found to differentiate between successful candidates of the three groups at the end of the course would then obviously be of no significant help in the actual task of differential prediction. To account for the differences found it was hypothesized that in spite of the fact that the three groups were equated on the basis of the Inductive Reasoning test which came closest to measuring the general mental ability factor, the Science group was still the brightest of the three. The hypothesis found support when the ages of the pupils in the three groups were compared. Table 7·3 gives the average ages of the pupils in the three groups calculated on the basis of the equated samples.

TABLE 7·3

Average Ages of Pupils in the Three Groups Caiculated on the Basis of the Equated Samples.

Group	Age
Science	13 years 10 months
Arts	14 years 9 months
Commerce	14 years 5 months

It may be seen that a difference as large as of 11 months exists between the Science and Arts groups and of 7 months between the Science and Commerce groups. In view of the fact that intelligence continues to grow during this period, the child who performs as well on an intelligence test as an older child is definitely superior to the latter in terms of brightness or I.Q. On tests which provide age norms, a gain of about two months usually means a gain of one I. Q. point. The relative brightness of the Science group as compared to the Arts and Commerce groups is thus apparent.

Following are the results of analysis of variance involving the successful candidates in the three courses at the end cf grades IX, X, and XI.

I. Analysis of Variance Involving Succesaful Candidates in the Three Groups at the and of Grade IX.

Table 7·4 gives the means and variances of successful candidates in the three groups at the end of grade IX.

Table 7.5 gives the reaults of the analysis of variance.

TABLE 7·5

Results of Analysis of Variance Involving Successful Candidates in the Three Cnurses on the Nine Independent Variables at the End of Grade IX (N=339)

X_1

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	589·61	2	294·8
Within Sets	16,812·34	336	50·04
Total	... 17,401.95	338	

F=5·89 Significant at .01 level

X_2

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	192·26	2	96·13
Within Sets	19,864·34	336	59·12
Total	... 20,056,60	338	

F=1·62 N.S.

X_3

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	225·24	2	112·62
Within Sets	40,640·26	336	120·95
Total	... 40,865·50	338	

F=·93 N.S.

TABLE 7·5 (Continued)

X_4

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	2·70	2	1·35
Within Sets	30,287·33	336	90·14
Total ...	30,290·03	338	

F=·015 N. S.

X_5

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	577.64	2	288·82
Within Sets	17,070·88	336	50·80
Total ...	17,648·52	338	

F=5·66 Significant at .01 level

X_6

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	84·20	2	42·10
Within Sets	20,428·00	336	60·8
Total ...	20,512·20	338	

F=·69 N. S.

TABLE 7·5 (Continued)

X_7

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	101·37	2	50·68
Within Sets	7,955·14	336	23·68
Total ...	8,056·51	338	

F=2·14 N. S.

X_8

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	39·25	2	19·62
Within Sets	30,966·75	336	92·16
Total ...	31,006·00	338	

F=.21 N. S.

X_9

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	369·76	2	184·88
Within Sets	35,381·74	336	105·30
Total ...	35,751·50	338	

F=1·75 N. S.

The analysis shows that only two tests, namely, Verbal Facility and Mechanical Reasoning differentiate between successful candidates of Sciece-Arts and Science-Commerce groups. No test differentiates between successful candidates of the Arts-Commerce groups. As indicated earlier the differentiation on the basis of the above two tests cannot be taken at face value because it was on these two tests that the Science group was definitely superior at the beginning of the course. It may, therefore, be ccncluded that none of the tests included in the battery can differentiate between successful candidates of the three groups when the success criterion is passing the IX grade examintion.

II. Analysis of Variance Involving Successful Candidates in the Three Groups at the End of Grade X.

Table 7·6 gives the means and variances of successful candidates in the three groups at the end of grade X.

Table 7.7 gives the results of the analysis of variance.

Table 7.7

Results of Analysis of Variance Involving Successful Candidates in the *Three Courses* on the Nine Independent Variables at the End of Grade X (N=259)

X_1

Components	Sum of Squares	Degrees of Freedom	Variance
Between groups	333·99	2	167.00
Within groups	14,537.31	256	56·79
Total	... 14,871.30	258	

F=2.94 Not significant.

X_2

Components	Sum of Squares	Degrees of Freedom	Variance
Between groups	172·20	2	86·10
Within groups	15,104·71	256	59·00
Total	... 15,276·91	253	

F=·1·5 N. S.

X_3

Components	Sum of Squares	Degrees of Freedom	Variance
Between groups	35·69	2	17·85
Within groups	33,152·36	256	129·50
Total	... 33,188·05	258	

F=·14 N. S.

TABLE 7·7 (Continued)

X_4

Components	Sum of Squares	Degrees of Freedom	Variance
Between groups	74·39	2	37·2
Within groups	22,510·14	256	87·93
Total ...	22,584·53	258	

F=·42 N. S.

X_5

Components	Sum of Squares	Degrees of Freedom	Variance
Between groups	483·60	2	241·8
Within groups	13,176·07	256	51·47
Total ...	13,659·67	258	

F=4·70 Significant at ·01 level

X_6

Components	Sum of Squares	Degrees of Freedom	Variance
Between groups	51·97	2	25·99
Within groups	14,618·70	256	57·10
Total ...	14,670·67	258	

F=·46 N. S.

TABLE 7·7 (Continued)

X_7

Components	Sum of Squares	Degrees of Freedom	Variance
Between groups	200·34	2	100·17
Within groups	6,134·33	256	23·96
Total ...	6,334·67	258	

F=4·18 Significant at ·05 level

X_8

Components	Sum of Squares	Degrees of Freedom	Variance
Between groups	77·10	2	38·55
Within groups	24,679.65	256	96·40
Total ...	24,756·75	258	

F=·4 N. S.

X_9

Components	Sum of Squares	Degrees of Freedom	Variance
Between groups	326·34	2	163·17
Within groups	27,577·41	256	107·72
Total ...	27,903·75	258	

F=1·51 N. S.

At this level the two tests which seem to differentiate between successful candidates of the three groups are (1) Mechanical Reasoning which differentiates between successful candidates of the Science and Commerce courses (t=3·06, which is significant at ·01 level), and (ii) Rote Memory which differentiates between successful candidates of Science and Arts courses (t=2·79, significant at ·01 level). It will be recalled that so far as Rote Memory is concerned the Science group had a significantly higher mean at the beginning of the three-year course though the difference at that time was significant only at ·05 level.

It will, however, be seen what picture emerges at the end of grade XI.

III. Analysis of Variance Involving Successful Candidates in the Three Groups at the End of Grade XI.

Table 7·8 gives the means and variance of successful candidates in the three groups at the end of grate XI.

TABLE 7·9

Results of Analysis of Variance Involving Successful Candidates in the *Three Courses* on the Nine Independent Variables at the End of Grade X (N=211)

X_1

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	426·32	2	213·16
Within Sets	9,754·23	208	46·89
Total ...	10,180·55	210	

F=4·55 Significant at ·05 level

X_2

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	10·6	2	5·30
Within Sets	10,963·1	208	52·66
Total ...	10,963·7	210	

F=·1 N. S.

X_3

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	455·48	2	227·74
Within Sets	23,633·01	208	113·62
Total ...	24,088·49	210	

F=2·0 N. S.

TABLE 7·9 (Continued)

X_4

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	533·24	2	266·62
Within Sets	17,998·89	208	86·53
Total ...	18,532·13	210	

F=3·08 Significant at ·05 level

X_5

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	491·30	2	245·65
Within Sets	11,055·04	208	53·15
Total ...	11,546·54	210	

F=4·62 Significant at ·05 level

X_6

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	71·93	2	35·96
Within Sets	11,086·51	208	53·30
Total ...	11,158·44	210	

F=.67 N. S.

TABLE 7·9 (Continued)

X_7

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	99·68	2	49·84
Within Sets	5,336·07	208	25·65
Total ...	5,435·75	210	

F=1·49 N. S.

X_8

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	165·92	2	82·96
Within Sets	20,973·71	208	100·83
Total ...	21,139·63	210	

F=·82 N. S.

X_9

Components	Sum of Squares	Degrees of Freedom	Variance
Between Sets	127·76	2	63·88
Within Sets	21,652·60	208	104·10
Total ...	21,780·36	210	

F=·61 N. S.

At this stage there are three tests which seem to differentiate between successful candidates of the three groups, two of which are again Verbal Facility and Mechanical Reasoning which now differentiate between successful candidates of Science and Commerce but not of Science and Arts courses. There is no test which can differentiate between successful candidates of Science and Arts courses. However, the Verbal Facility test now also differentiates for the first time between successful candidates of Arts and Commerce courses ($t=2.41$, significant at .04 level).

The third test, namely. Inductive Reasoning on which the three groups had been equated also appears for the first time as a differentiating test between successful candidates of Science and Commerce courses. We could have put some faith in the power of this test to differentiate between successful candidates of the two courses, had it not been for the fact that at the XI grade it has failed to differentiate even among the successful and unsuccessful candidates of the Commerce course. In other words, it is differentiating almost equally well between successful Science and successful Commerce and between successful Science and unsuccessful Commerce students, which makes it useless as a differentiating tool.

The more important point about the Inductive Reasoning test, however, is that it has failed to differentiate between successful candidates of the three courses at almost all the levels. The study thus casts serious doubt on the assumption usually made by counsellors and guidance workers that the Science course requires a higher level of intelligence than is required in Arts and Commerce courses. One of the reasons why such a misconception prevails among our counsellors is that in actual practice a majority of more intelligent children are admittod to the Science course and the less intelligent ones are sent to the Arts and Commerce courses bringing about a wide diaparity in the intellectual levels of the three groups as will be seen from the means of the unequated samples on the Inductive Reasoning test, (See Table 6. 3.). The means of Arts and Commerce groups which are 15.28 and 70.04 respectively are not only considerably lower than the mean for the Science group which is 24.73, but are also significantly lower than what would be required for success in the two courses. The means of successful candidates of Arts and Commerce courses at the end of grade XI are 22.64 and 80.64 respectively.

These facts should be of concern to our school authorities. Less intelligent students in the Arts and Commerce courses not only affect educational standards, but also bring down the quality of work when they take up jobs. It can hardly be over-emphasized that as a free nation we are at a stage when an equitable distribution of our talents is most essential for an all-round and integrated development of our economy. We can ill afford to stuff any sector of our work with mediocres alone. Shall we rest content with high quality scientists, doctors and engineers alone ? Or do we also need writers, historians, social scientists, men of letters, businessmen and industrialists of an equally high calibre who would be lenders in their own fields and capable of bringing about changes which would significantly contribute to the nation's progress and well-being ? The role of intelligence in high-level achievement, whatever be the field of work, can hardly be over-emphasized.

Returning to our problem of differentiation between successful candidates of the three courses, we may conclude that there is not much possibility of such a differentiation on the basis of ability factors included in this study. This research finding is in line with the conclusion drawn from researches on differential prediction by means of differential aptitude tests. Commenting upon the low differential validity of multiple aptitude batteries as a group, Anastasi (1961) wrote, "Perhaps academic criteria, against which most multiple aptitude batteries have so far been validated, are not clearly differentiable on the basis of aptitudes. It is possible that differences in performance in specific courses depend primarily on interests, motivation, and emotional factors. Unpredictable contingency factors, such as interpersonal relations between an individual student and a particular instructor, may also play a part." (pp. 357-58).

It seems then that our counsellors, at the present stage of test development, will have to rest content with telling the counselee about his chances of success (against failure) in the three courses on the basis of critical scores in significant factors revealed by this study. But as for the problem of differential prediction of pupil's success in the three courses, they will have to depend more on data regarding his interests, motivation and life goals.

CHAPTER VIII

Summary and Conclusions

1. The present study was undertaken to test the hypothesis that the abilities required for success in the three Higher Secondary School courses, namely, Science, Arts (Humanities) and Commerce wil! differ in kind or degree or both. A second hypothesis of the study was that it was possible, on the basis of the ability tests used, to differentiate among pupils at the beginning of the Higher Secondary course with regard to their comparative chances of success in the three courses.

2. A differential aptitude battery of eight tests together wilh an Interest inventory for Science and Study Hebits inventory for all the three groups was administered to 1,104 pupils admitted to the three courses in five Higher Secondary Schools of urban Delhi.

3, The distribution of scores on the Inductive Reasoning test which showed wide disparity between means of the three groups necessitated the study to be carried out on comparable samples of 180 each so that the hypothesis of the study could legitimately be tested.

4. Two types of criteria, namely, composite scores in major subjects at the end of grade IX, and pass-fail results at the annual examination of grades IX, X, and XI, were used for this study.

5. One hundred and seventeen Pearson r's were worked out to have all the intercorrelations of the test variables. Only 9 pairs of intercorrelations out of a total of 108 were found to be significantly different, 7 at 5% level of significance and 2 at 1% level of significance,

6. Zero order correlations numbering 28 were worked out between test variables and criterion of success (composite scores in major subjects in each of the three courses) at the end of grade IX. 4 values

of r for the Science, 6 values of r for the Arts and 4 values of r for the Commerce course were found to be significant at .01 level. 1 value of r for the Science, 2 values of r for the Arts and 1 value of r for the Commerce course were found to be significant at .05 level. Multiple R's were also worked out for each group. The maximum R's for the three courses were found to be .394 for Science, .531 for Arts and .381 for the Commerce course with the best combinations of 3, 2, and 2 variables for the three courses respectively.

7. Biserial r's were worked out for all the test variables, except interest, with pass-fail as the criterion at the end of grades IX, X, and XI. The results indicated a rather stable factor pattern for the Science and Arts courses but not for the Commerce course. The magnitudes of correlations also for the Science and Arts courses were as high as could be expected on the basis of factor tests, the best single correlation being .54 for Science and .57 for Arts.

8. The data were also analyzed with the use of analysis of variance technique which yielded the same results.

9. Analysis of variance technique was also used to find out if there were tests which could differentiate between successful candidates of the three courses. The results were disappointing.

Conclusions

1. The study supports the hypothesis that the combination of factors required for success in the three courses does show some appreciable differences both in kind and in degree. Thus while Inductive Reasoning assumes the greatest importance for the Science course, Verbal Meaning turns out to be the best single predictor for the Arts and Commerce courses, the magnitude being highest for the Arts course. The second best predictor for Science is Verbal Meaning; for Arts, Numerical Facility; and for Commerce, Verbal Facility; A combination of two factors in each case seems to provide the best multiple correlation.

2. Speaking of the comparative usefulness of the factor tests included in this battery in predicting academie success, it may be said that out of the 8 ability tests only three, namely, Verbal Meaning, Inductive Reasoning and Numerical Facility seem to be important.

3. Study habits and interest, when measured by inventories of the type included in this study, do not seem to contribute significantly to prediction of academic success.

4. With the type of correlations obtained for the three courses, the study suggests that better prediction is possible for those subject areas with which the pupils had longer familiarity. This is in agreement with some previous research findings which have shown that cognitive *skills* are acquired in relation to subject-matter fields and not as skills that could be generally applied. (Ser Furst, 1950)

5. The study shows that differential prediction with the help of differential aptitude tests when academic criteria are involved is not a very promising approach.

6. The study casts serious doubt on the assumption made by many counsellors and guidance workers that a significantly higher level of general mental ability is required for success in the science course than required for success in the Arts and Commerce courses, at least at the Higher Secondary stage.

CHAPTER IX

Implication of Present Research

The study for the first time puts to the test the assumption made by the Secondary Education Commission (1953) in organizing the Secondary School courses on differential pattern. They wrote :

> By the end of the middle school the special abilities and interests of the pupils would generally be taking definite form; at least it will be so with most of the pupils. So the curriculum at the high school stage (both for high schools and higher secondary schools) should be, as far as possible, framed on the basis of these abilities and interests.

They confessed, however, that "We have no scientific data available to help us to arrange in categories if that were possible these special abilities and interests in terms of well-defined and compact educational programmes."

In the light of the above statement so clearly made by the Commission the findings of the present study are not only a pointer to a more scientific planning of the courses and curricula at the secondary stage but alo bring into clear relief the urgent need for guidance of a more scientific character, if a scheme of differential education is at all to be made successful. When it is remembered that for a large majority of pupils the higher secondary stage is going to be the end of formal schooling the importance of the findings of this study assumes greater proportions especially with regard to man-power, planning and utilization of human resources.

The findings which are of direct and immediate help to educational workers at higher secondary level are briefly indicated here.

1. Straightforward prognosis of academic success in curricular courses at the "delta" stage should give meaningful purpose to individual

guidance. Counselling work gains in importance as counsellor has a relatively firm foundation upon which to build his counselling programme.

2. Vocational guidance too gains in meaning when proper curricular choices are made.

3. The School programme including class room instruction would lead to more satisfying goals both with regard to pupil achievement and school's efforts to help the child realize his potentialities to the maximum possible extent.

4. School failures and school drop-outs which undermine our educational economy today would be considerably decreased under the impact of scientific guidance.

5. The effect of scientific guidance at the secondary stage would also reflect itself in improvement of college material and educational standards at all levels beyond the middle stage.

It is, however, important to remember that guidance based on factor-test scores could be improved a good deal if other types of data are used and test results are interpreted in terms of all the information that can be gathered. Measures of ability, as is well known, tell us what a person can do, but what a person will do in real life situations depends on a host of personality characteristics and environmental conditions which need to be understood and combined with test data for proper guidance. Information such as pupil's expressed interests. achievements, or mental and physical health, wishes and goals, social and cultural background, and home conditions, will be found helpful by the counsellor in helping his counsellee to make wise choice of his course of study, With all the pertinent data before him the counsellor will find the test results very revealing and of considerable usefulness for making reliable and valid decisions, Neither of the two types of data when considered alone is of much use in guidance work. There are always blind spots present in the life of the individual, which come to light only when the total picture is in view.

6. Out of the three courses studied, the Commerce course is the least predictable one on the basis of this test battery. Also there is no well-formed pattern of abilities emerging out for this course, as is evident from the correlation with the pass-fail criterion obtained at successive stages from grades IX through XI. More research is needed to find out whether

inclusion of some other factor-test or tests will improve the prediction. There is, however, reason to believe, as Furst (1950) found, that a student's level of performance in a certain thinking skill in one subject matter area bears little relationship to the level of performance in the same skill in another area. In other words, his study indicated, for example, that the ability to judge the validity of data in physical science bears little relationship to student's ability to judge the validity of the data in social sciences. Thus thinking skills are acquired in relation to subject-matter fields and not as skills that could be generally applied.

It follows then that if the multipurpose scheme is to be successfully implemented, it is essential that pupils at the junior high school stage should be provided with ample opportunities to develop their cognitive skills and interests along various lines. It is well known that abilities and interests do not develop in a vacuum. They require a rich environment for their proper growth and development. Identification of talent is a fruitless attempt under conditions which do not allow their natural fruition. The point is well taken by the Secondary Education Commission (1953) in their Report when they emphasize the need for a broad-based curriculum at the middle school stage which, according to them, is to be of an "exploratory character." "By providing a broad-based and general curriculum," so they write, "and an appropriate environment in the school we can help the child to discover his own tastes and talents." (p. 83). The present study reinforces the need for such an approach in curriculum planning at the middle school stage.

7. When the three courses, namely, Science, Humanities and Commerce are involved the battery could be safely shortened by the exclusion of Spatial Visualization test. Rote Memory, Study Habits, and Interest Inventory too seem to be of doubtful validity. This is in line with other researches in the field of differential aptitude testing. Achievement in most academic subjects is usually best predicted by a combination of tests which measure verbal, numerical and a broad reasoning factor. Spatial and other aptitudes may be highly predictive of success in certain fields of employment but are seldom predictive of school marks. This is probably due to the fact that school success is largely or wholly the result of written examinations. (Nunnally: 1964),

Need for Further Research

The study is suggestive inasmuch as it points to the need for developing a more comprehensive, factorially pure, battery of tests to include all the six groups to be instituted in a full-fledged multipurpose school. Further research studies would then be needed on differential prediction basis to develop regression weights for all the six groups. Better evaluation systems which are now being introduced in Indian secondary schools sare likely to bring about improvement in factor patterns to the extent the reliability and validity of the criterion are improved.

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The study tests the hypothesis that over-and under-achivevement of scholastic grades is directly related to the reward value of high grade marks for the individual student.

Meyer, Wilhim J. "The Stability of Patterns of Primary Mental Abilities Among Junior High and Senior High School Students." *Educational and Psychological Measurement*, 20 : 795-800, Winter, 1960.

Results domonstrate (a) increasing stability of test patterns with ages and (b) increasing differentiation of the primary ability with age, particularly in the case of numerical and spatial. Considerable caution is suggested in making long-range prediction with the PMA, particularly when a subject scores around the average.

Middleton, C. Jr. and Guthrie, G.M, "Personality Syndromes and Academic Achievement." *Journal of Educational Psychology* 50 : 66-69, 1959.

An attempt has been made to delineate the personality syndromes among high achieving and low achieving students.

Mitchell, B. C. "Relation of High School Achievement to the Abilities Measured by the Holzinger-Crowder Unifactor Tests." *Educational and Psychological Measurement*, 15 : 487-90, 1955.

It is a straightforward validity study Involving four separate measures of Verbal, Spatial, Numerical, and Resoning Ability in the Holzinger-Crowder Uni-Factor Tests. A large number of correlations with achievement tests and teacher marks as criteria for success in the high school courses have been reported.

Mollenkopf, W. G. Some Aspects of the Problem of Differential Prediction. "*Educational and Psychological Measurement*, 12 : 39-44, 1952.

The paper considers the simplest case of differential prediction, in which the choice is limited to two alternative courses of action a and b, and it is desired to predict for a given individual whether his likelihood of success is better in a than in b.

Nicksick, Theodore Jr. and Beamer, George C. "Aptitude Patterns for Selected Major Fields of Study." *Personnel and Guidance Journal*, 38 : 43-45, September, 1959.

The study attempts to determine whether the aptitude factors, G (intelligence), V (verbal aptitude), N (numerical aptitude), S (spatial aptitude), P (from perception), and Q (clerical perception), of the GATB, can discriminate between students in selected major fields of study at North Texas State College. The results show that on the basis of the aptitudes used in this study a differentiation among the major fields can be made.

North, R. D. "The Use of Multifactor Aptitude Tests in School Counseling." *Proceedings 1955 Invitational Conference on Testing Problems*, Princeton, N. J., Educational Testing Service, 1956. P. 9-15.

Evaluetes the value of multifactor tests in relation to general intelligence tests.

Summarizes studies made at the University of Minnesota in predicting scholastic achievement in the college of science, literature and the arts, and College of Agriculture, Foresty and Home Economics.

University of Minnesota Studies in Predicting Scholastic Achievement, Part I Minneapolis : The University of Minnesota Press, 1942. P. 74.

Summarizes a series of investigations in the prediction of scholastic success in certain professional schools of the University of Minnesota, namely, Medical, Nursing, Business Administration, Law, and Dentistry.

Wallace, W. L. "Differential Predictive Value of the ACE Psychological Examinations." *School and Society*, 70 : 23-25, 1949.

There is lack of any marked difference between the predictive values of the two parts, Q and L in most typical university freshman courses.

Wallace, W. L. "Prediction of Grades in Specific College Courses." *Journal of Educational Research*, 44 : 587-97, April 1951.

Results show that there is not a marked difference in the predictive value of the different tests for success in the broad areas studied. Results have only limited appliection.

Wellman, F. E. "Differential prediction of High School Achievement Using Single Score and Multiple Factor Tests of Mental Maturity." *Personnel and Guidance Journal*, 35 : 512-17, April, 1957.

The use of a test battery composed of a single score test of mental ability and a multiple-factor test for the prediction of differential achievement at the 9-10 grade level appears to be justified from the results of this study.

Wesman, A. G. "Aptitude Testing for Differential Prediction." *Growing Points in Educational Research*. Official Report of the American Educational Research Association, 1949 : P. 187-93.

A useful paper clarifying many concepts related to differential prediction. Deals with such topics as prerequisites for successful prediction, methods of differential description and prediction, etc.

Wesman, A. G. and Bennett, G. K. "Problems of Differential Prediction." *Educational and Psychological Measurement*, 11 : 262-72, 1951.

The paper is an excellent exposition of the problems involved in differential prediction and serves as a good background material for the research worker to study.

Wolfle, D. and Oxtoby, T. "Distribution of Ability of Students Specializing in Different Fields." *Science*, 116 : 311-14, September 26, 1952.

It is found that those fields which have the reputation of requiring abstract and rigorous thinking (e. g., physics, chemistry, law) attract students who are on the average superior to those who major in traditionally "easier" subjects (e. g., business, commerce, or education). But the distributions all overlap.

Osborn, Duncan. "The Relationship of Personality Factors to Academic Achievement in College." Ph.D. Dissertation. New York, Teachers College, Columbia University, 1963. 55 p. Typewritten.

Murray's need and press system for conceptualizing personality is used as the theoretical framework for constructing hypothesis concerning relationship between certain personality factors and academic achievement in college.

Pickrel, E. W. "Classification Theory and Techniques. *Educational and Psychological Measurement*, 18 : 17-46, Spring, 1958.

Presents an excellent overview of the generalized classification problem and the various techniques which have been developed for handling special aspects of this problem.

Rausch, C. P. "The Effects of Individual Variability on Achievement." *Journal of Educational Psychology*, 39 : 469-78.

The results of the study indicate that heterogeneity of the individual in various abilities and traits is not conducive to superior achievement.

Roesslein, C. G. *Differential Patterns of Intelligence Traits Between High Achieving and Low Achieving High School Boys*. Catholic University of America Press, 1953.

The study investigates by the method of factor analysis the differential patterns of intelligence of two groups of high school boys.

Schwilck, O. L. "Academic Achievement of Freshmen High School Students in Relationship to Class Load and Scholastic Aptitude." *Personnel and Guidance Journal*, 37 : 455-56, February, 1959.

The survey implied that factors other than ability and academic load are important in predicting achievement.

Sharp, H. C. and Pickett, L. M. "The General Aptitude Test Battery as a Predictor of College Success." *Educational and Psychological Measurement*, 19 : 617-23, 1959.

The study shows that certain aptitudes from the complete battery of the GATB are fair predictors of success in college.

Shaw, D. C. "Study of the Relationships Between Thurstone Primary Mental Abilities and High School Achievement: Summary of Dissertation." *Journal of Educational Psychology*, 40 : 232-49, April, 1949.

The paper reports among other things an investigation of the combinations and weightings of the various mental abilities that give best prediction of achievement and the efficiency with which the best combinations predict achievement.

Stone, J. B. "Differential Prediction of Academic Success at Brigham Young University." *Journal of Applied Psychology*, 38 : 109.110, April, 1959.

Provides multiple regression equations which can be used in the differential prediction of academic success in four college curricula at Brigham Young University: (a) commerce; (b) elementary education; (c) Physical sciences; and (d) social sciences.

Super, Donald B. "The Use of Multifactor Test Batteries in Guidance." *Personnel and Guidance Journal*, 35 : 9-15, 1956.

Discusses several basic issues relating to the use of multifactor test batteries in guidance. The article introduces a series of articles on the available multifactor test batteries.

Tempero, H. E. and Ivanoff, J. M. "Cooperative School and College Ability Test As a Predictor of Achievement in Selected High School Subjects." *Educational and Psychological Measurement* 20 : 835-38, Winter, 1960.

Results indicate that the SCAT is a valid instrument in predicting high school achievement in selected subject areas as measured by standardized achievement tests.

Travers, Robert H. W. "Significant Reseach on the Prediction of Academic Success." *The Measurement of Student Adjustment and Achievement*. Ed. by Donahue, Wilma T. Coombes, Clyde **H**., and Travers, Robert M. W. Ann Arbor: University of Michigan Press, 1949. p. 147-90.

An excellent review of researches done in the field of academic predicton at all levels.

Travers, R. M. "Prediction of Achievement." *School and Society*, 70 : 293-94, November, 1249.

An attempt is made to point out some of the major weaknesses of prediction studies and the assumptions thereof.

University of Minnesota Studies in Predicting Scholastic Achievement, Part I. Minneapolis: The University of Minnesota Press, 1942. 65 p.

APPENDIX A

*Report on A Predictive Battery of Differential Scholastic Aptitude**

Probably the most useful and practical aspect of statistics as an applied science is available in its predictive functions under the general laws of probability. Such prediction is naturally not astrological and is liable to error[1] for which an estimate is generally available. Even near certainties are available but pronouncements are in terms of percent chances for the group rather than the individual. Prediction is available on material that may be presented in categories or in quantity gradation of any degree of refinement. Category to category or quantity to quantity and mixed type of predictions have been made possible by the use of measures of various types of relationship and covariation among given variables.[2] In the project under report full advantage of these statistical techniques was to be taken in predicting the future of students contemplating different options at the commencement of the High School in the Madhya Pradesh before the reorganization of States. A battery of tests yields a set of scores which could be statistically so combined as to give the best prediction in any given direction of scholastic proficiency.

It has been found that general mental ability begins to get differentiated by the interaction of environment and the individual after the age of 11+.[3] A general factor can always be looked for and established even after that age. In fact what its size would be would depend directly on the tests put together and analysed. If, however, our interest is in differentiation then the single factor diagnosis cannot help. Even in the London school[4] concept of factorial composition of ability the general factor gets split later into bipolars like k: m: and v:ed.. and further special factors. It was therefore decided to produce tests which may show a minimum of overlap of functions as in the multiple factor view of Thurstone.[5] As specialization starts only after the 9th class of the old-fashioned High School (with Matriculation coinciding with the 11th class), this class was treated as the delta stage where-onwards the single stream of boys and girls would begin to diverge and split into channels of specialization. The mean age of this class towards the end of the course in February-March was found to be 15 year which was so well beyond 11+ that the differentiation of the generalized power into more restricted types of functions could be presumed as sufficiently advanced. The Primary Mental Ability type of test battery could be taken as answering the purpose of inter-subject discrimination at this stage.

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* This research was carried on under the direction of [Principal M. Varmas, with the cooperation of some members of staff of the University Training College, Nagpur. Shri Varma has since Joined the Gorakhpur University as Professor of Education.

There is as Hull[6] has pointed out a factor for general scholastic aptitude but this was not what the intended battery sought. It sought the difference among aptitudes for different subjects (or subject-groups as in the Multipurpose scheme) in terms of the tests. An aptitude may be defined as "a measure of the probable rate of learning which results in interest and satisfaction and is relatively specific and narrow".[7]

The intention was thus to produce a battery of tests of maximally independent functions for the 9th class of the High School, which variously combined would predict the probable efficiency with which any given student may take some of the available optional courses at that stage.

There existed a nucleus of eight tests at the University Training College. One more test was added to this and both Hindi and Marathi versions were developed. Thus Hindi and Marathi versions of the following tests were put up :

S. No.	Name	No. of items in final draft	Response type	Time in Minutes
1.	Numerical	64	Productive	12
2.	Verbal	70	6-choice	20
3.	Inductive Reasoning	50	Productive	40
4.	Deductive Reasoning	50	2-choice	12
5.	Spatial	75	2-choice	40
6.	Perceptual Speed	50	6-choice	6
7.	Finger Dexterity	—	Productive	2.5
8.	Rote Memory	21	Productive	9
9.	Physical Relations	50	3-choice,	20

These functions were represented in the tests by items which had shown in previous factor studies pure loadings in factors which gave names to the tests. Thus Verbal was represented by antonym-synonym type of item which had shown an average loading of .80 in the factor[8] in two studies, uncontaminated by any other factor.[8]

Samples for Hindi version were not large in town and, after re-organization, in the Marathi districts of the old Madhya Pradesh. These tests thus remaind a parallel series to be administered and organized into sub-batteries in the course of some years. Sufficient sample of Marathi knowing boys were readily availabe and three types of such samples were taken viz. Nagpur, Out of Town (Urban),and Out of Town (Vocational). Decile norms for these samples are furnished with the test-booklet. The N for these samples ranged from 360 to 776. Test 9 was developed later and norms for it are not yet available.

Item analysis for the eight tests had been earlier done by the use of Fan's Item Analysis Table in use at Educational Testing Service at Princeton.[9] The nature of the items did not requrie many items to be outright expunged except in Test 2 and 5. In others only reordering by level of difficulty was called for.

This battery it was believed could be trained on any criterion of a scholastic nature with the logical and strong expectation that its predtctive relationship and power would be demonstrated. To demostrate the technique four subjects of the ordinary High School curriculum were selected for regression weigts to be calculated. Following standard methods[10] it was found that all the eight tests need not be retained in the prediction formula. For example, using raw scores of tests the followining equations will produce a composite score which will be the closest to the given criterion score (examination mark) in each case as out of 100.

Language

$$Y_1 = .29\,X_1 + .45\,X_2 + .20\,X_4 + 10$$

Geography

$$Y_g = .29\,X_1 + .34\,X_2 + .04\,X_7 + 13$$

Science

$$Y_g = .4\,X_1 + .6\,X_2 + .4\,X_3 + .05\,X_7$$

Maths.

$$Y_a = X_1 + .6\,X_2 + .3\,X_3 + 1.6\,X_8 - 33$$

Where Y's are the estimated criterion values and X's the raw scores in tests indicated by the subscript; the additives are constants of such equations. By inserting raw score values the estimate of the given criterion (viz. probable examination mark in that subject) can be easily obtained.

The reliabilities and validities of the above four sub-batteries are shown in the manual and prove the recognized fact that ability and aptitude only pertially account for the scholastic proficiency shown by a student at an examination. It is recognized that a multiplicity of factors, some of them personalistic, others purely adventitious enter into the examination results as we obtain them under normal conditions in India. These latter are by no chance even sufficiently reliable and therefore a maximum coverage of the criterion of the order, say, of .66 in case of Maths. With only four tests in the battery unsupplemented by achievement tests or teacher's estimates (Mclelland) is as good a validation of a battery as may be expected. Also it is only by getting used to mental tests that Indian children will learn to react sensibly and coolly to them. This could not be expected in the present case when most students met such tests for the first time.

A further enquiry was concerned with the difference among test functions. Kelly's formula[11] was found handy for this and gave the following results for the tests involved in the above four equations.

Reliablities of differences between tests

	1	2	3	4	7	8
1		.62	.77	.60	.73	.77
2			.73	.53	.82	.73
3				.73	.87	.90
4					.60	.69
7						.84

This showed that tests 2 and 4 were not well differentiated due to a common verbal element and Test 1 was also related to 2, and 4 to 7 partly through a common speed element. The other difference reliabilities are good.

In the last round of this investigation it was decided to subject one sample to factor analysis and see how the tests behaved in relation to common factors.

The Nagpur sample with N=623 yielded the following factors after orthogonal rotations :

Factors

Tests	I_3	II_1	III_1	IV_1	h^2
1	31	20	20	21	22
2	28	02	38	29	30
3	38	—02	18	60	53
4	—10	48	58	11	59
5	13	15	15	19	10
6	58	50	—06	..	59
7	—08	71	—21	26	62
8	22	15	13	...	09

The residuals were checked by McNemar's and Burt's method[12] and found non-significant after the 4th factor. In the above it would seem as if Factor IV represents the kind of abstract thinking we call intelligence which has a high saturation in Inductive function represented by Test 3. Tests 6 and 8 (perceptual speed and Rote memory) completely miss this. Factor II is opposed to this and has a high mechanical speed element showing nearly no loading in 9 but highest in 7 (Finger dexterity). Factor 13 is a complex of sub-functions and is the result of the orthogonality condition of rotations.

Prospects

The prospects of the present battery are (1) extension of its use to other school subjects, (2) the administration of the Hindi versions wherever possible over a numper of years till sufficient data collects for standardization. These norms are not likely to differ from the Marathi version except in case of test 2 (Verbal) and test 4 (Deductive on Verbal meterial) where the substance of the test is changed. The other will not give materially different results if the two populations are alike in age and ability. (3) The incorporation of test 9 (Physical Relations) in the battery for other predictions and prediction on science. This test was not ready by the first round of administration and would show a good relation to physics.

The case of seeking prediction not on single isolated narrow subjects like language or geography but on grouped studies like humanities, sciences, social studies, calls for organizing these studies within their own group so that a weighted composite representing all may be obtained. This may be done on rational considerations or by other statistical methods like factorization if common samples showing proficiency in all sub-studies are available.[12] Probably the best solution would be to have a common sample showing proficiency in all sub-studies of a group (this is likely to present administrative hurdle) with degrees of proficiency in each and scores on all the tests and thereafter work out canonical correlations for regression weights giving maximum correlation between the two sets of variables.

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APPENDIX B

Copies of Text Material Used

प्रश्न-पत्रिका

इस पन्ने को मत उलटो और
इसपर कुछ भी मत लिखो

UNIVERSITY TRAINING COLLEGE

TEST I

नीचे दिए गए संकेतों को ध्यानपूर्वक पढ़ोः—

(१) प्रश्न—पत्रिका में प्रश्न क्रमपूर्वक दिए गए हैं। उत्तर पत्रिका में रिक्त स्थान भी उसी क्रम में दिए गए हैं। प्रत्येक प्रश्न का क्रमांक भलीभाँति देखकर, उत्तर-पत्रिका में उसी क्रम के रिक्त स्थान में उस प्रश्न का उत्तर लिखो।

(२) इस परीक्षा में पन्ने के बाईं ओर कुछ शब्द दिए गए हैं। उनको ठीक तरह से सजाने पर एक वाक्य तैयार होता है। उत्तर में तुमको यह बताना है कि इस प्रकार तैयार हुआ वाक्य **ठीक** है अथवा **गलत**।

(३) उदाहरणः—

खाती घास है गाय ठी **ग**

ऊपर दिए गए शब्दों को सजाने पर 'गाय घास घाती है' नामक वाक्य तैयार होता है। यह 'वाक्य' ठीक है। इसलिए 'ठी' और 'ग' (ठीक और गलत) में से 'ठी' के नीचे लकीर खींच दी गई है। याद रखो कि वाक्य 'ठीक' होने पर 'ठी' के नीचे और 'गलत' होने पर 'ग' के नीचे लकीर खींचना है।

अब कुछ और उदाहरण देखोः—

प्रश्नांक	शब्द	उत्तर	
१	हैं होते हरे पेढ़ के पत्ते	ठी	ग
२	होता है रंग लाल का हाथी	ठी	ग
३	तैरता है पानी में पत्थर	ठी	ग
४	में डंक के बिच्छू रहता है विष	ठी	ग

पहले प्रश्न में तैयार होने वाला वाक्य 'पेड़ के पत्ते हरे होते हैं' ठीक है, इसलिए 'ठी' के नीचे लकीर खींच दी गई है। दूसरे और तीसरे प्रश्न में तैयार होने

वाले वाक्य 'हाथी लाल रंग का होता है' और 'पत्थर पानी में तैरता है' गलत है इस लिए उनके उत्तर में 'ग' के नीचे लकीर खींच दी गई है। इसी प्रकार चौथे प्रश्न का वाक्य 'बिच्छू के डंक में विष रहता है' ठीक होने के कारण 'ठी' के नीचे लकीर खींच दी जाती है।

(४) अब उत्तर-पत्रिका में अपना नाम और कक्षा इत्यादि लिखो।

(५) **अभ्यास**—नीचे दिए गए चार प्रश्नों के उत्तर, उत्तर पत्रिका में प्रथम चार अंकों के सामने लिखो।

प्रश्न-पत्रिका पर कुछ भी मत लिखो

प्रश्नांक	शब्द
१.	चमक है होती की बिजली वहुत तेज।
२.	हैं होते पंख के चिड़िया दो।
३.	रंग की हरे है होती भैंस।
४.	कड़वी है होती बहुत शक्कर।

कोई शंका हो तो पूछो। **जब तक कहा न जाय इस पन्ने को मत उलटो।**

जब तक कहा न जाय इस पन्ने को मत उलटो।

प्रश्नांक प्रश्न

१. होती है बुद्धि में मनुष्य।
२. है उदय होता सूरज में रात।
३. दौड़ने पसीना से है निकलता।
४. जड़ें के नीचे पेड़ होती हैं।
५. बिल्ली है डरती से चूहे।
६. इनाम है मिलता से करने चोरी।
७. होती है शीतलता में प्रकाश चंद्रमा के।
८. हमें रोशनी से दिए मिलती है।
९. पानी से बादलों है बरसता।
१०. दिखाई है पड़ने लगता हमें साफ से अँधेरा होने।
११. पसीना करने से खूब व्यायाम आता है।
१२. साइकिल के सहारे दो पहियों चलती है।
१३. नहीं है हवा को आवश्यक बहुत मनुष्य।
१४. कोट नीचे के कमीज पहना है जाता।
१५. केला प्रकार का फल एक है।
१६. बाप बेटे और की उम्र है समान होती।
१७. एक घोड़ा दो पायों वाला है प्राणी
१८. ठंडक में है पड़ती यहाँ अपने गर्मी बहुत।
१९. है जो जन्म लेता मरता है वह एक दिन भी।
२०. मधुरता में है होती बहुत कौए की आवाज।
२१. आने से घर गिर जाते हैं भूकम्प।
२२. टोपी की पैर में है पहनने वस्तु।
२३. यात्रा में है कर सकते हम जहाज के लकड़ी समुद्र की।
२४. वर्फ में पानी रुप के जमाने को आवश्यकता की गर्मी हैं।
२५. वर्षा को हानि होती है समय पर न आने से अनाज।

अगले पेज पर के प्रश्न करो।

प्रश्नांक प्रश्न

२६. बिजली के मनुष्य को बहुत फायदा हुआ है आविष्कार से ।
२७. रेडियो के लिए जीवन और बिजली अन्न से भी अधिक जरूरी हैं ।
२८. बीमारियाँ को कई प्रकार की मनुष्य हो जाती हैं न स्वच्छ रहने से ।
२९. परीक्षाओं में प्रचलित अपने देश से भिन्न है आज की कुछ परीक्षा ।
३०. यश करने से हमें बुरा काम प्राप्त होता है अच्छा और सब कहते है हमें ।
३१. कौवे के बाहर मछलियाँ रह सकते हैं किंतु पानी नहीं ।
३२. आकार का गेंद होता है गोल वह और रबड़ जाता का हैं बनाया ।
३३. तेज होने से धार की चाकू लकड़ी की जलाने है काटी जा सकती ।
३४. भयानक हैं एक पशु और बकरी को वह दूसरे जानवरों खा जाती है ।
३५. दो सींग के होते हैं घास ओर खाता हैं वह कुत्ते बड़े चाव से ।
३६. आँखें होने पर हमें खराब चश्मा लगाना चाहिए जिससे कि कमजोर न हो जाय और दृष्टि ।
३७. नियमित स्वास्थ्य करने से बच्चों का व्यायाम बिगड़ जाता है इसलिए नहीं बच्चों को व्यायाम करना चाहिए ।
३८. जल्दी ही अच्छे हो जाते है दवा उचित बीमार मनुष्य खिलाने से ।
३९. चूहे और नेवले में रहता है बैर ही वैसा जैसा साँप और बिल्ली में ।
४०. श्रेष्ठ है समझा जाता वह मनुष्य हँसते हँसते झेल को लेता है जो मुसीबतों ।
४१. अँधेरी रात से होने हम दिए में जलाते हैं होली ।
४२. ईंट की कपास करके तैय्यार घर हम हैं बनाते ।
४३. वर्षा ऋतु तैय्यार किए जाते हैं कुर्सी और पलंग तो उससे सूख जाती है जब लकड़ी में ।
४४. समाज की उन्नति के लिए आवश्यक है न लोग झगड़ा करें आपस में कि ।
४५. कारण के ठंड लगने है पहनते ऊन में हम कपड़े के जाड़े ।
४६. जो कि पहाड़ों पेदा होते है पर ऐसे हमें मजबूत लकड़ी से पेड़ों मिलती हैं ।
४७. कमजोर को कर देता है रोग आदमी और ध्यान से देने तरफ उसकी न जाता है वह मर ।
४८. द्वारा तैय्यार की जाती वे बढ़ई हैं कारखाने में जिन रेलगाड़ी पर पटरियों चलती है ।
४९. समय में जानते हैं मूल्य का जीवन लड़के जिससे कि अच्छे पछताना नहीं पड़ता उनको चलकर आगे ।
५०. अँधेरे मे दिखता को है बिल्ली तलाश की इसलिए शिकार में को रात घूमती है वह रहती ।

समाप्त होने पर जांच लो ।

प्रश्न-पत्रिका

इस पन्ने को मत उलटो और
इसपर कुछ भी मत लिखो

UNIVERSITY TRAINING COLLEGE
TEST II

नीचे दिए गए आदेशों को ध्यानपूर्वक पढ़ो :—

(१) प्रश्न–पत्रिका में प्रश्न क्रमपूर्वक दिए गए हैं उत्तर–पत्रिका में रिक्त स्थान भी उसी क्रम से दिए गए हैं। प्रत्येक प्रश्न का क्रमांक भलीभांति देखकर, उत्तर–पत्रिका में उसो क्रम के रिक्त–स्थान में उस प्रश्न का उत्तर लिखो।

(२) स्पष्ट लिखो। कोई उत्तार गलत मालूम पड़ने पर उसे काटकर सही उत्तर फिर से स्पष्ट रूप से लिखो। जो उत्तार ठीक से पढ़ने में नहीं आएगा उसके नम्बर काट लिए जाएँगे : अंक अंग्रेजी में लिखो।

(३) उत्तर–पत्रिका में उत्तर के सिवाय और कुछ मत लिखो। बिना कच्चा काम किए हुए उत्तर दो।

(४) **उदाहरण**:–अब कुछ उदाहरण देखो :—

प्रश्नांक	प्रश्न		उत्तर
1.	36+25	=	61
2.	45+22	=	23
3.	62× 3	=	186
4.	83÷ 5	=	17

ऊपर के उदाहरणों में, जोड़, बाकी, गुणा, भाग के प्रश्न दिए गए हैं और उनके सही उत्तर भी प्रत्येक प्रश्न के सामने लिख दिए गए हैं। इसी प्रकार के प्रश्न इस प्रश्न–पत्रिका में हैं और उनके उत्तर तुमको, जितनी जल्दी बन सके, उत्तार–पत्रिका में लिखना हैं।

अब उत्तर–पत्रिका में अपना नाम और कक्षा इत्यादि लिखो।

(५) **अभ्यासः**—नीचे दिए गए चार प्रश्न के उत्तर, **उत्तर–पत्रिका में** प्रत्येक प्रश्न का क्रमांक भली भाँति देखकर लिखो—

प्रश्नांक	प्रश्न
1.	$95+25$
2.	$120-80$
3.	244×3
4.	$124\div4$

(६) अब अपनी पेंसिल हाथ में लेकर अपनी सीट पर सीधे होकर बैठ जाओ और जब तक कहा न जाय, इस पन्ने को मत उलटो। 'प्रारम्भ'–इस प्रकार की आज्ञा मिलते ही पन्ना उलट कर उत्तर देना शुरू कर दो और 'समाप्त' की आज्ञा होते ही काम रोक कर प्रश्न--पत्रिका बंद कर दो। इसमें जरा भी देर नहीं लगना चाहिए।

कोई शंका है, तो पूछो। **जब तक कहा न जाय इस पन्ने को मत उलटो**

जब तक कहा न जाय इस पन्ने को मत उलटो।

प्रश्नांक	प्रश्न
1	13+97
2	47+74
3	29−15
4	46−21
5	213×3
6	326×5
7	232÷4
8	352÷8
9	53+19
10	73+68
11	61−44
12	82−65
13	571×6
14	709×4
15	340÷5
16	744÷6
17	86+61
18	97+82
19	93−14
20	79−22
21	986×7
22	809×9
23	873÷9
24	609÷7
25	147+255
26	231+502
27	156−113
28	309−199
29	2215×3
30	3027×5
21	5721÷3
32	2545÷5

अब अगले पन्ने के प्रश्न हल करो ।

प्रश्नांक	प्रश्न
33	409+523
34	799+805
35	438−385
36	790—407
37	5809×7
38	9087×9
39	4338÷6
40	7101÷9
41	1102+2312
42	2035+7612
43	1241−1020
44	1580−1134
45	13502×2
46	25601×5
47	1096÷8
48	4151÷7
49	4165+3428
50	7903+9015
51	6302—5018
52	9089−7903
53	49673×7
54	89095×9
55	14442÷6
56	36379÷7
57	10625+79531
58	83679+99006
59	53102—32182
60	78093—57736
61	390879×6
62	920576×8
63	174486÷6
64	496566÷7

प्रश्न-पत्रिका

इस पन्ने को मत उलटो और इस पर कुछ भी मत लिखो

UNIVERSITY TRAINING COLLEGE

TEST III

नीचे लिखे गए संकेतों को ध्यानपूर्वक पढ़ो:—

(१) प्रश्न-पत्रिका में प्रश्न क्रमपूर्वक दिए गए हैं। उत्तर-पत्रिका में रिक्त स्थान भी उसी क्रम से दिए गए हैं। प्रत्येक प्रश्न का क्रमांक भलीभाँति देखकर, उत्तर-पत्रिका में उसी क्रम के रिक्त स्थान में, उस प्रश्न का उत्तर लिखो।

(२) प्रश्न-पत्रिका में प्रत्येक शब्द के सामने छ: शब्द दिए हुए हैं। इन छः शब्दों में से, प्रश्न के रूप में दिए गए शब्द का समानार्थी अथवा विरुद्धार्थी शब्द तुमको खोज कर निकालना है। यह समानार्थी अथवा विरुद्धार्थी शब्द प्रश्न-पत्रिका में जिस क्रम पर हो, उत्तर-पत्रिका में प्रत्येक प्रश्न के सामने उसी क्रमांक पर इस प्रकार का (/) चिन्ह लगाओ। याद रक्खो कि उत्तर-पत्रिका में प्रत्येक प्रश्न के लिए **एक ही** (/) चिन्ह लगाना है। एक से अधिक (/) चिन्ह लगाने पर उत्तर गलत समझा जायगा।

(३) **उदाहरण:**—प्रश्न-पत्रिका में इस प्रकार के प्रश्न दिए गए हैं।

प्रश्नांक	प्रश्न	उत्तर					
		१	२	३	४	५	६
१.	शुद्ध, इसका अर्थ है	सफेद	उत्तम	सुन्दर	अच्छा	पवित्र	गंदा
२.	मित्रता, ,, ,, ,,	लड़ाई	दुश्मनी	झगड़ा	दोस्ती	हँसी-मज़ाक	मारपीट
३.	ठंडक, इसका उलटा है	जाड़ा	गरमी	बरसात	धूप	दिन	सूरज
४.	हलका ,, ,, ,,	छोटा	चौड़ा	भारी	लंबा	ऊंचा	बड़ा

उत्तर-पत्रिका में उत्तर देने की विधि:—

उत्तरांक		उत्तर					
१.	...	१	२	३	४	~~५~~	६
२.	...	१	२	३	~~४~~	५	६
३.	...	१	~~२~~	३	४	५	६
४.	...	१	२	~~३~~	४	५	६

(५) प्रश्न–पत्रिका में **नं.१ से नं.३५ तक समानार्थी शब्द** पूछे गए है और **नं. ३६ से नं. ७० तक विरुद्धार्थी शब्द ।**

(६) अब उत्तर–पत्रिका में अपना नाम और कक्षा इत्यादि लिखो ।

(७) **अभ्यास:**—नीचे दिए गए चार प्रश्नों के उत्तर **उत्तर–पत्रिका में**, प्रथम चार अंकों के सामने दो ।

प्रश्न–पत्रिका पर कुछ भी मत लिखो ।

प्रश्नांक	प्रश्न	उत्तर					
		१	२	३	४	५	६
१.	यश, इसका अर्थ है	बदनामी	बड़ाई	अच्छाई	सुन्दरता	कोमलता	पवित्रता
१.	भ्रमण, ,, ,; ,,	जाना	लौटना	घूमना	सोना	जागना	बैठना
३.	मुलायम, इसका उलटा है	दुबला	पतला	चिकना	गोल	सुन्दर	कड़ा
४.	कटु, ,, ,, ;,	सच्चा	ईमानदार	लोभी	कड़ा	मधुर	कठोर

कोई शंका हो तो पूछो । जब तक कहा न जाय इस पन्ने को मत उलटो ।

जब तक कहा न जाय इस पन्ने को मत उलटो।

प्रश्न		उत्तर						
			१	२	३	४	५	६
१ लघु	इसका अर्थ है	१	छोटा	बारीक	बौना	लंबा	टेढ़ा	ऊंचा
२ मौन	,, ,,	२	मैना	चिड़िया	चुप	मोर	सम्मति	शोर
३ अश्व	,, ,,	३	हाथी	बैल	गाय	घोड़ा	बकरा	गधा
४ उदधि	,, ,,	४	नदी	नाला	पहाड़	बन	समुद्र	पृथ्वी
५ धवल	,, ,,	५	काला	सफेद	नीला	पीला	हरा	लाल
६ प्रतिमा	,, ,,	६	मिट्टी	पत्थर	स्वच्छ	मूर्ति	श्याम	हलकी
७ शीतलता	,, ,,	७	गर्मी	ठंडक	उष्णता	तरलता	निर्मलता	पवित्रता
८ तम	,, ,,	८	उजेला	दिन	रात	सफेद	काला	अंधेरा
९ निर्भीक	,, ,,	९	चालाक	तेज	कमजोर	साहसी	डरपोक	बुद्धिहीन
१० कठोर	,, ,,	१०	कठिन	कड़ा	मुलायम	कोमल	हलका	भारी
११ वंचल	,, ,,	११	आकाश	बादल	वर्षा	मेघ	बिजली	वारिद
१२ पक	,, ,,	१२	कीचड़	तालाब	धूल	बालू	नदी	जल
१३ कार्यालय	,, ,,	१३	मकान	बंगला	स्कूल	घर	दफ्तर	झोंपड़ी
१४ समीप	,, ,,	१४	दूर	ऊपर	नीचे	पास	आगे	सामने
१५ धूर्त	,, ,,	१५	गंदा	आदमी	निर्धन	सरल	सभ्य	चालाक
१६ बात	,, ,,	१६	बातचीत	हवा	पानी	आग	आकाश	धरती
१७ स्थिर	,, ,,	१७	चंचल	बहाना	रुका	स्थगित	उड़ता	सोता
१८ वेदना	,, ,,	१८	सुख	चिल्लाना	हंसना	रोना	पाड़ा	मारना
१९ संदेह	,, ,,	१९	लोभ	घृणा	विश्वास	ईमानदारी	शक	दया
२० उन्नत	,, ,,	२०	नीचा	ऊंचा	ऊपर	पीछे	दूर	पास
२१ बहुधा	,, ,,	२१	कभीकभी	अभीअभी	अक्सर	प्रतिदिन	आजही	कलतक
२२ अहंकार	,, ,,	२२	क्रोध	झगड़ा	घमंड	आदर	भय	ईर्ष्या
२३ मूल्यवान	,, ,,	२३	अच्छी	तेज	बुरी	कीमत	कीमती	सुन्दर
२४ तृप्ति	,, ,,	२४	जिज्ञासा	बेचैनी	संतोष	मोह	भ्रम	शंका
२५ बिख्यात	,, ,,	२५	कमजोर	ईमानदार	प्रसिद्ध	भला	बुरा	कंजूस
२६ परामर्श	,, ,,	२६	उपदेश	सलाह	सान	डांटना	मारना	सहायता
२७ संपन्न	,, ,,	२७	खाली	रिक्त	खोखला	पूर्ण	आधा	शेष
२८ भट	,, ,,	२८	चक्रवर्ती	सम्राट	वीर	पंडित	पुजारी	मंत्री
२९ प्रतिष्ठा	,, ,,	२९	सम्मान	अहंकार	प्रतिहिंसा	अपमान	श्रद्धा	भक्ति
३० साधना	,, ,,	३०	पवित्रता	उन्नति	तपस्या	त्याग	गांभीर्य	करुणा
३१ प्रतिशोध	,, ,,	३१	मित्रता	दोस्ती	दुश्मनी	बदला	क्रोध	वैर
३२ आत्मीय	,, ,,	३२	पराया	दूसरा	अपना	किसका	उसका	मुझको
३३ उत्थान	,, ,,	३३	गिरना	पड़ना	बैठना	उन्नति	अवनति	चौंकना
३४ स्वावलंबन	,,	३४	एकता	अनेकता	आत्मनिर्भता	आत्मत्याग	आत्मसंयम	सत्य
३५ उत्तरदायित्व	,,	३५	सहूलियत	जिमेदारी	आसानी	जवाव	कठिन	सरल

अब अगले पन्ने के प्रश्न करो।

	प्रश्न		उत्तर						
				१	२	३	४	५	६
६६	पवित्र इसका उलटा है		३६	गंदगी	चरित्र	सावित्री	पतन	भ्रष्ट	निर्मल
३७	शत्रुता	,,	३७	झगड़ा	युद्ध	मित्र	दोस्ती	लड़ाई	मारपीट
३८	विश्वास	,,	३८	भय	झूठ	क्रोध	डर	संदेह	छल
३९	तम	,,	३९	अँधेरा	बिन	सूरज	रात	चाँदनी	प्रकाश
४०	तरल	,,	४०	कठोर	शुष्क	पतला	ठोस	गहरा	हलका
४१	रिक्त	,,	४१	खाली	संपन्न	सम्पूर्ण	भरा	रक्त	लाल
४२	अमर	,,	४२	भाग्यवान	मरणशील	जीवन	मृत्यु	जरा	जड़
४३	प्रसन्नता	,,	४३	हँसना	हँसाना	शोक	सुख	रोना	चिल्लाना
४४	शक्तिशाली	,,	४४	योद्धा	वीर	दुर्वल	बलवान्	पराजित	सबल
४५	परिश्रम	,,	४५	मेहनत	आराम	मजदूरी	खाना	खुदाई	लेटना
४६	गँवार	,,	४६	पागल	भिखारी	मूर्ख	सभ्य	सच्चरित्र	सुन्दर
४७	संकुचित	,,	४७	स्वार्थी	परमार्थी	विशाल	सुधारक	संकोच	एकत्रित
४८	सम्मान	,,	४८	अनादर	बड़ाई	प्रशंसा	बहादुरी	महत्ता	महत्व
४९	उपयोगी	,,	४९	अच्छी	सुन्दर	सन्यासी	साधू	हीन	वेकार
५०	स्वच्छ	,,	५०	साफ	शुद्ध	पवित्र	बुरा	गंदा	शोभामय
५१	भीरु	,,	५१	डरपोक	बहादुर	सज्जन	दुर्जन	भीड़	भय
५२	क्षुद्र	,,	५२	महान	नीच	समान	सहोदर	छोटा	पतित
५३	अंबर	,,	५३	वायु	अग्नि	आकाश	पाताल	जल	मेघ
५४	अनुराग	,,	५४	स्नेह	प्रेम	मातृत्व	ममता	दया	घृणा
५५	जड़	,,	५५	सूक्ष्म	अचेतन	चेतन	सजल	मोटी	ठोस
५६	गहन	,,	५६	सघन	गहरा	उथला	विरल	जंगल	गह्वर
५७	शांत	,,	५७	उत्तेजित	भयानक	कठोर	अनुरागी	दुःखी	प्रशाँत
५८	उदार	,,	५८	दानी	निर्मोही	उधार	कंजूस	सानी	मूर्ख
५९	पराजय	,,	५९	हार	संधि	सलाह	जीत	परामर्श	कमन
६०	सत्यवादी	,,	६०	मिष्टभाषी	कटुभाषी	दयालु	चोर	झूठा	बेईमान
६१	पुरातन	,,	६१	प्राचीन	ऐतिहासिक	खंडहर	नवीन	आकर्षक	निर्बल
६२	विलक्षण	,,	६२	चमत्कारिक	साधारण	उत्तम	सुन्दर	अनन्य	अपूर्व
६३	व्यवस्थित	,,	६३	बिखरा	सँजोना	सँवारना	व्यवहार	इकट्ठा	बर्त्ताव
६४	अनभिज्ञ	,,	६४	बुद्धिलीन	व्यर्थ	जानकार	सूचना	बालक	अजान
६५	अपरिमित	,,	५५	अनेक	परिमाण	नाप	बहुत	सीमित	भारी
६६	गतिमय	,,	६६	चलना	रुकना	निश्चल	दौड़ना	भागना	निर्भय
६७	लंपट	,,	६७	मूर्ख	बेईमान	अपराधी	सीधा	कुत्सित	सभ्य
६८	साकार	,,	६८	मूर्त्ति	व्रह्म	एकाकार	निराकार	अनेकाकार	प्रकार
६९	अलभ्य	,,	६९	लाभहीन	अजीब	घाटा	लाभप्रद	प्राप्य	हानि
७०	प्रतिभाशाली		७०	विद्वान	मंदबुद्धि	प्रसिद्ध	परिश्रमी	चालाक	पापी

प्रश्न-पत्रिका इस पन्ने को मत उलटो और इसपर कुछ भी मत लिखो

UNIVERSITY TRAINING COLLEGE

TEST IV

नीचे दिए गए आदेशों को ध्यान पूर्वक पढ़ो :—

१ प्रश्न-पत्रिका में प्रश्न क्रमपूर्वक दिए गए हैं। उत्तर-पत्रिका में रिक्त स्थान भी उसी क्रम से दिए गए हैं। प्रत्येक प्रश्न का क्रमांक भलीभाँति देखकर उत्तर-पत्रिका में उसी क्रम के रिक्त स्थान में उस प्रश्न का उत्तर लिखो।

२ उत्तर स्पष्ट रूप से पढ़ने में आना चाहिए। जो उत्तर ठीक से पढ़ने में नहीं आएगा, उसके नम्बर काट लिए जाएँगे।

३ **उदाहरण**—अब कुछ उदाहरण देखो—इस प्रश्नों में अक्षरों का क्रम समझने के पश्चात् आगे के दो अक्षर लिखना है।

प्रश्नांक	प्रश्न	उत्तर
1.	A A A A A B B B B C C C D— —	D, E
2.	A A B C C D E E F G G— —	H, I

इसके प्रथम पंक्ति का नियम यह है कि हर एक अगले अक्षर की संख्या एकसे कम होती गई है। C तीन बार आवा, D दो बार और E एक बार। दूसरी पंक्ति में एक अक्षर दो बार और उसके आगे का अक्षर एक बार आता है, इसलिए H एक बार आने पर I दो बार आयेगा।

(४) अब उत्तर-पत्रिका में अपना नाम और कक्षा इत्यादि लिखो।

(५) **अभ्यास**—नीचे दिए गए चार प्रश्नों के उत्तर, उत्तर-पत्रिका में प्रथम चार अंकों के सामने लिखो।

प्रश्न-पत्रिका पर कुछ भी मत लिखो।

(अँग्रेजी वर्णमाला के अक्षर ; A B C D E F G H I J K L M N O P Q R S T U V W X Y Z)

प्रश्नांक	प्रश्न
1.	I J K L M N O P Q R S — —
2,	A A A B B B C C C D D D E E — —
3.	A B B C D D E F F G H — —
4.	A A A B B C C C D D E E E F — —

अँग्रेजी वर्णमाला के अक्षर प्रत्येक पन्ने पर दिए गए हैं।

कोई शंका है तो पूछो। **जब तक कहा न जाय इस पन्ने को मत उलटो**

जब तक कहा न जाय इस पन्ने को मत उलटो।

(अंग्रेजी वर्णमाला के अक्षर : A B C D E F G H I J K L M N
O P Q R S T U V W X Y Z)

1. A A B B C C D D E E F F— —
2. Z Z Z Y Y Y X X X W W W W V V V U U — —
3. A B A C A D A E A F A G A H A – —
4. Z A Z B Z C Z D Z E Z F Z G Z H Z I — —
5. A B B C C C D D D D E E E E E F F F F — —
6. X X K X X L X X M X X N X X O X X P X X — —
7. A B B B A C C C A D D D A E E E A F F — —
8. H H H H H H I I I I I J J J J K K K L — —
9. O A B O C D O E F O G H O I J O K L— —
10. A A A B C C C D E E E F G G G H I I — —
11. A B B B C D D D E F F F G H H H I J — —
12. A A B A A C A A D A A E A A F A A— —
13. Z Y X W V U T S R Q P — —
14. A B B A C C A D D A E E A F F A G — —
15. A B B A A C C A A D D A A E E A A G — —
16. A Z Z B Y Y C X X D W W E V V F U U G T — —
17. Z A A Y B B X C C W D D V E E U— —
18. A B C C D E F F G H I I J K L L M N O — —
19. B B A C C B D D C E E D F F E G — —
20. A N B O C P D Q E R F S G T H — —

21 A B C A D E A F G A H I A J K A L M A N — —

22. A Z E Y C X D W E V F U G T H — —

23· A Z Z B B Y C X X D D W E V V F F U G T — —

24. A Z C Y E X G W I V K U — —
25. A C C B D D C E E D F F E G — —

अब अगले पन्ने के प्रश्न हल करो

(अंग्रेजी वर्णमाला के अक्षर । A B C D E F G H I J K L M N
O P Q R S T U V W X Y Z)

26. A B C N O P D E F Q R S G H I T U V J K — —

27. A B B A B C C B C D D C D E E D E F — —

28. A B C C B C D D C D E E D E F F E F G — —

29. A B C D B C D E C D E F D E F G E F G H F
G H F G H — —

30. A B C B C D C D E D E F E F G F G — —

31. C B A F E D I H G L K J O N M R Q — —

32. A B I J C D K L E M N G H O P I J Q R K — —

33. A B Y Z C D W X E F U V G H S T I J — —

34. A B C N O P B C D O P Q C D E P Q R D E F Q R—

35. B D F H J L N P R T — —

36. X Y Z U V W R S T O P Q L M N I J — —

37. A B C A C D A D E A E F A F G A G H A H I A — —

38. C B A D C B E D C F E D G F E H G — —

39. A D B E C F D G E H F I G J H K I — —

40. A E I O U Y W B C D F G H J K L M N — —

41. E D C B A F E D C B G F E D C H G F E D I H G F E

42. D C B A E D C B F E D C G F E D H G F E I H G F—

43. B A D C F E H G J I L K N M P O R Q T — —

44. A B A B C B C D C D E D E F E F G — —

45. A C E B D F C E G D F H E G I F H — —

46. C A B D B C E C D F D E G E F H F G I G H J — —

47. X Y Z W X Y V W X U V W T U V S T U R S — —

48. A C B B D C C E D D F E E G F F H G G I — —

49. A B D B C E C D F D E G E F H F G I G H J H — —

50. A B C D D B C D E E C D E F F D E F G G E F G H

समाप्त होने पर जांच लो ।

प्रश्न-पत्रिका इस पुस्तिका पर कुछ भी मत लिखो

UNIVERSITY TRAINING COLLEGE

TEST V

नीचे दिये गए आदेशों को ध्यान पूर्वक पढ़ो—

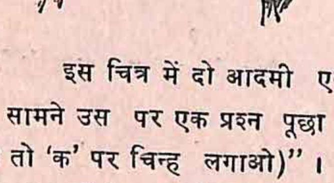
१. प्रश्न पत्रिका में प्रश्न क्रमपूर्वक दिए गए हैं। उत्तर पत्रिका में रिक्त स्थान भी उसी क्रम से दिये गए हैं। प्रत्येक प्रश्न का क्रमांक भली भाँति देखकर उत्तर पत्रिका में उसी क्रम के रिक्त-स्थान में उस प्रश्न का उत्तर लिखो।

२. इस परीक्षा के प्रश्नों का उत्तर देने के लिए तुम्हें उत्तर पत्रिका में दिए गए 'अ' 'ब' 'क' अक्षरों में से किसी एक के नीचे एक रेखा खींचनी होगी; इस तरह 'ब̲', जिसका अर्थ हुआ कि तुम 'ब' को ठीक उत्तर मानते हो।

३. प्रश्न पत्रिका और उत्तर पत्रिका पर किसी तरह की रेखा या चित्र न खींचो। अच्छी तरह समझने के पश्चात् तीनों में से किसी एक अक्षर के नीचे रेखा खींच कर उत्तर दो; प्रश्न का और उत्तर का क्रमवार नम्बर मिला लो फिर जवाब दो।

४. इस परीक्षा में कुछ चित्र दिए गए हैं और उनके विषय में प्रश्न पूछे गए हैं। उदाहरण १ के चित्र को देखो।

उदाहरण—१



कौनसा आदमी ज्यादा बोझ उठाए है?

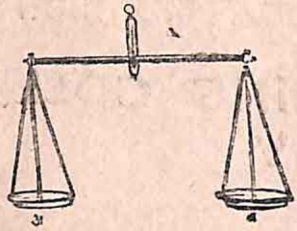
(बराबर हो तो 'क' पर चिन्ह लगाओ)

इस चित्र में दो आदमी एक तख्ता उठाए हैं जिस पर एक मशीन लगी है। चित्र के सामने उस पर एक प्रश्न पूछा है: "कौन सा आदमी ज्यादा बोझ उठाए है? (बराबर हो तो 'क' पर चिन्ह लगाओ)"। जिस आदमी पर 'ब' बना है तख्ते का अधिक भारी हिस्सा पकड़े है, इस लिए उत्तर पत्रिका में दिए अक्षरों से उत्तर इस तरह देना होगा;

उत्तर संख्या	उत्तर
१	अ ब̲ क

अब दूसरा उदाहरण देखो।

उदाहरण—२



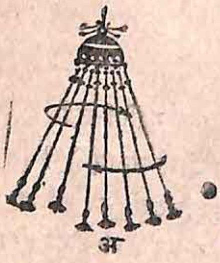
कौनसा पल्ला भारी है ?
(बराबर हो तो 'क' पर चिन्ह लगाओ)

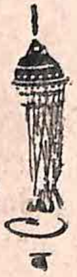
इस चित्र में तराजू के दोनों पल्ले बराबर हैं' इस लिए उत्तर पत्रिका में जवाब यों देना होगा—

उत्तर संख्या	उत्तर		
२	अ	ब	क

अभ्यास—

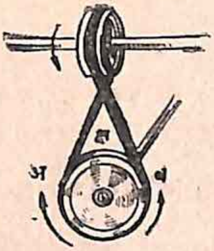
अब अभ्यास के लिये नीचे दिये प्रश्न का उत्तर उत्तर-पत्रिका में नाम आदि भरने के बाद दो





१
कौन से चित्र में गुरिए ज्यादा तेजी से घूम रहे हैं ?
(बराबर हो तो 'क' पर चिन्ह लगाओ)

कोई शंका हो तो पूछो। जबतक कहा न जाय इस पन्ने को मत पलटो।



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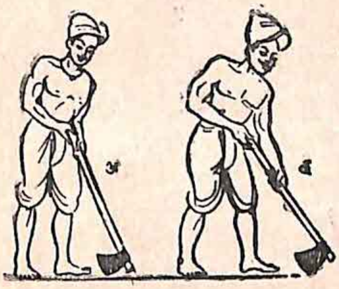
अगर ऊपर की घिर्री तीर से बताई दिशा में घूमे तो नीचे की घिर्री किस ओर घूमेगी ?

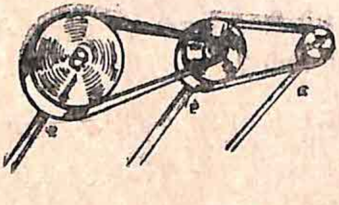
(किसी भी ओर घूम सकती हो तो 'क' पर चिन्ह लगाओ)



२

कौनसा आदमी कुल्हाड़ी को आसानी से उठा सकता है ?

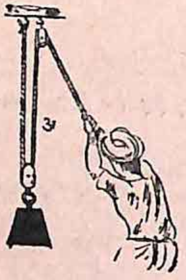
(बराबर हो तो 'क' पर चिन्ह लगाओ)

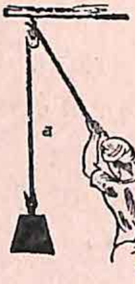


३

सबसे धीरे कौन सी धुरी घूमेगी ?

आगे के सवाल हल करो ।

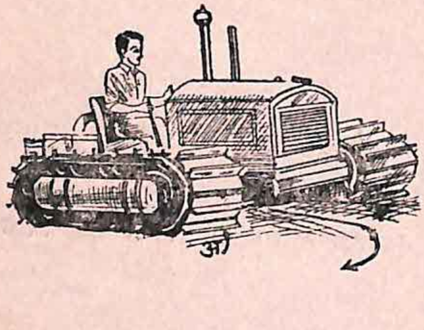




४

किस आदमी को वजन उठाने में ज्याद मेहनत लगेगी ?

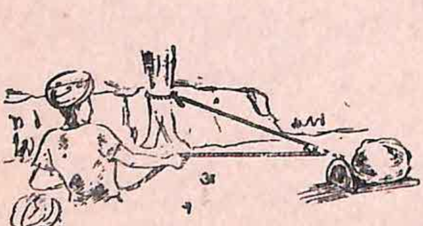
(बराबर हो तो 'क' पर चिन्ह लगाओ)

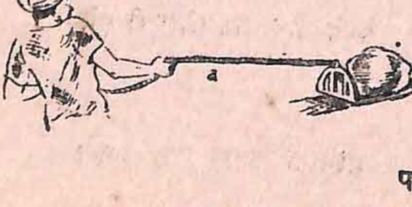


५

अगर मशीन तीर से बताई दिशा में घुमाई जाय तो कौनसा पहिया रुकेगा ?

(दोनों में से कोई भी हो तो 'क' पर चिन्ह लगाओ)



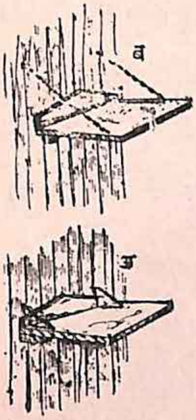


६

रस्सी किस आदमी को ज्यादा जोर से खींचनी पड़ेगी ?

(बराबर हो तो 'क' पर चिन्ह लगाओ)

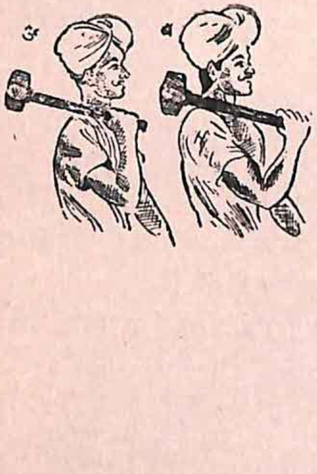
पन्ना उलट कर आगे के सवाल हल करो।



७

कौनसा तख्ता ज्यादा बोझ सह सकता है ?

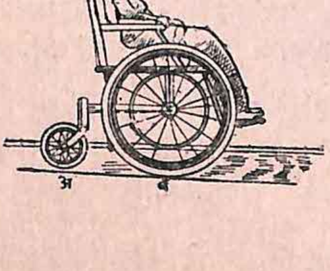
(बराबर हो तो 'क' पर चिन्ह लगाओ)



८

हथौड़ा कौन आदमी ज्यादा आराम से उठाए है ?

(बराबर हो तो 'क' पर चिन्ह लगाओ)

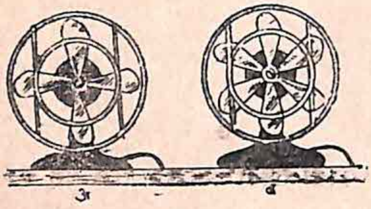


९

कौन सा पहिया ज्यादा तेजी से घूमता है ?

(बराबर हो तो 'क पर चिन्ह लगाओ)

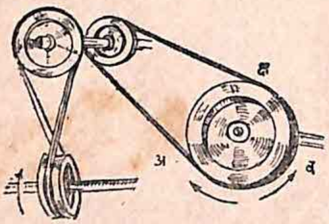
आगे के सवाल हल करो ।



१०

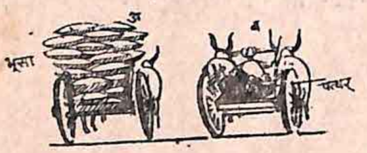
किस पंखे के घूमने में ज्यादा बिजली खर्च होगी ?

(बराबर हो तो 'क' पर चिन्ह लगाओ)



११

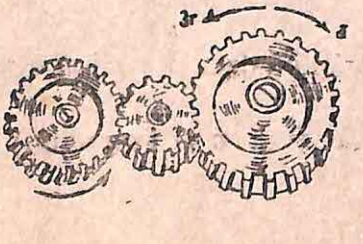
'क्ष' धुरी किस ओर घूमेगी ?
(दोनों में से किसी भी ओर हो तो 'क'
पर चिन्ह लगाओ)



१२

एक ओर ऊंची सड़क पर कौनसी गाड़ी पहले उलट जाएगी ?

(बराबर ख़तरा हो तो 'क' पर चिन्ह लगाओ)

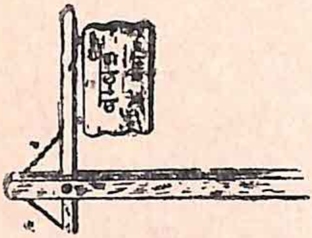


१३

जब बाईं तरफ वाला पहिया तीर से बताई दिशा में घूमेगा तो दाईं तरफ वाला किस ओर चलेगा ?

(किसी ओर चल सके तो 'क' पर चिन्ह लगाओ)

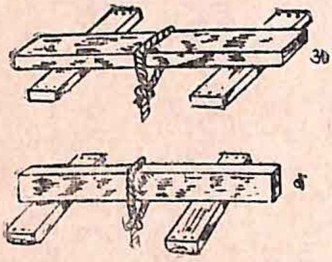
पन्ना उलटकर आगे के सवाल हल करो।



१४

कौन सी अकेली जंजीर डंडे पर लगे तख्ते को उठाए रख सकती है ?

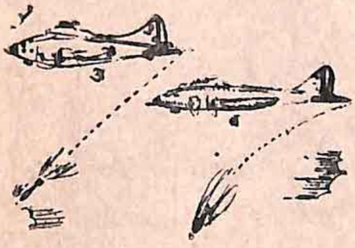
(कोई भी उठा रख सकती हो तो 'क' पर चिन्ह लगाओ)



१५

कौन सी रस्सी ज्यादा बोझ संभाल सकती है ?

(बराबर मज़बूत हो तो 'क' पर चिन्ह लगाओ)

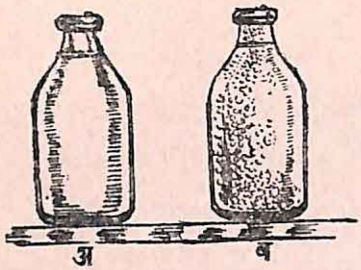


१६

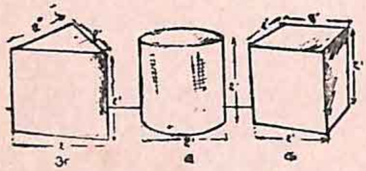
हवाई जहाज़ से बम का गिराना किस चित्र में ठीक दिखाया गया है ?

(दोनों तरह गिर सकता हो तो 'क' पर चिन्ह लगाओ)

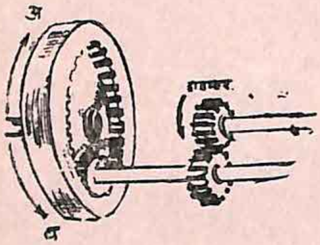
आगे का सवाल हल करो।



१७
कौन सी बोतल में बर्फ का ठंडा पानी भरा है ?
(यदि किसी में नहीं, तो 'क' पर चिन्ह लगाओ)

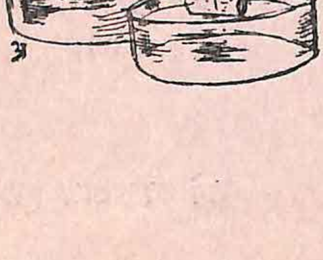


१८
तीनों में सबसे कम वजनी कौन है ?



१९
जब ड्राइवर तीर से बताई दिशा में घूमेगा तो बाईं ओर का बड़ा पहिया किस ओर चलेगा ?

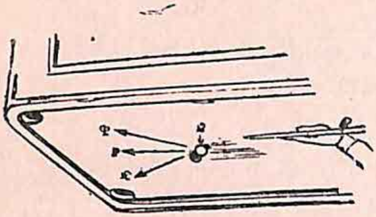
(दोनों ओर चल सके तो 'क' पर चिन्ह लगाओ)



२०
कौन से बर्तन में अधिक भारी द्रव्य पदार्थ भरा है ?

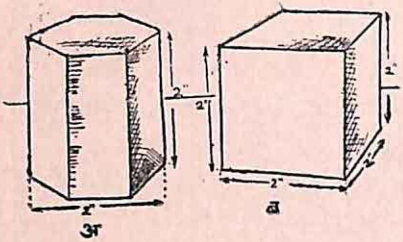
(बराबर हो तो 'क' पर चिन्ह लगाओ)

पन्ना उलट कर आगे के सवाल हल करो।



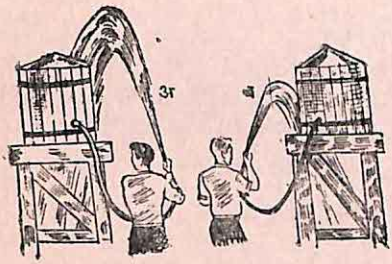
२१

काली गेंद से टकराने के बाद 'क्ष' गेंद किस दिशा में जाएगी ?



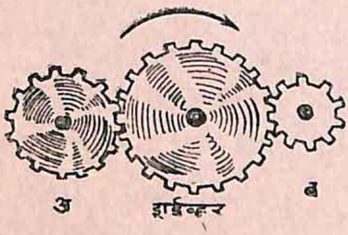
२२

कौन सा अधिक भारी है ?
(बराबर हो तो 'क' पर चिन्ह लगाओ)



२३

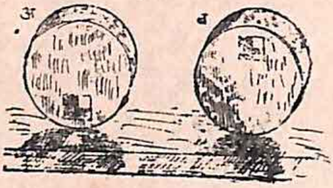
कौन चित्र सही है ?
(दोनों ठीक हों तो 'क' पर चिन्ह लगाओ)



२४

ड्राइवर पहिए की ही दिशा में कौनसा चक्र चलेगा ?
(दोनों में से कोई नहीं, तो 'क' पर चिन्ह लगाओ)

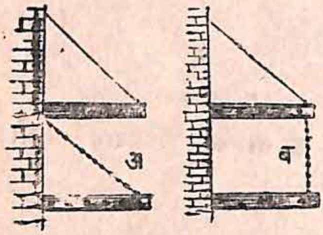
आगे के सवाल हल करो।



२५

छेददार लकड़ी का चक्र किस चित्र में सही खड़ा है ?

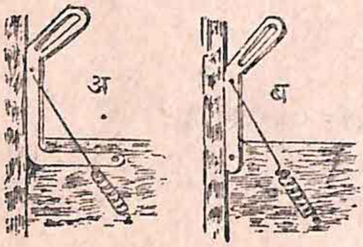
(दोनों गलत हों तो 'क' पर चिन्ह लगाओ)



२६

किस जंजीर पर खिंचाव ज्यादा पड़ रहा है !

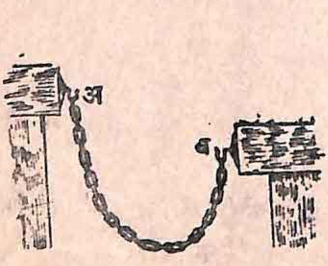
(बराबर हो तो 'क' पर चिन्ह लगाओ)



२७

कौन सा स्प्रिंग हैण्ड्ल को वहां रखेगा जहां वह अभी है ?

(अगर दोनों रखेंगे तो 'क' पर चिन्ह लगाओ)

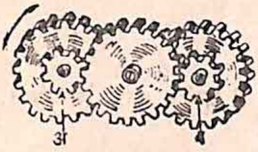


२८

कौन सा कांटा ज्यादा संभाले है ?

(बराबर हो तो 'क' पर चिन्ह लगालो)

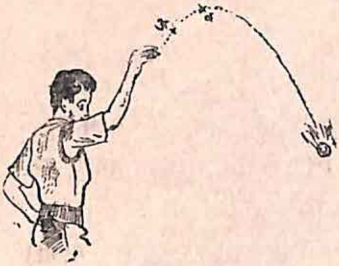
पन्ना उलट कर आगे के सवाल हल करो।



२९

दाएं बाएं वाले पहियों में कौनसा पहिया ज्यादा तेज़ घूमेगा ?

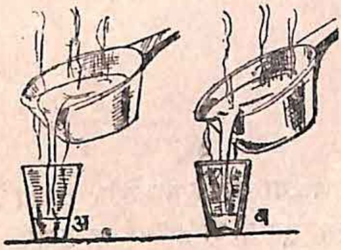
(बराबर घूमें तो 'क' पर चिन्ह लगाओ)



३०

किस स्थान पर गेंद की गति अधिक तेज़ होगी ?

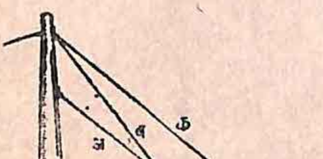
(बराबर हो तो 'क' पर चिन्ह लगाओ)



३१

कौन से गिलास के चटखने की अधिक सम्भावना है ?

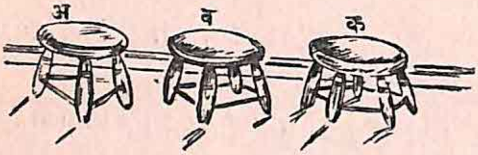
(बराबर हो तो 'क' पर चिन्ह लगाओ)



३२

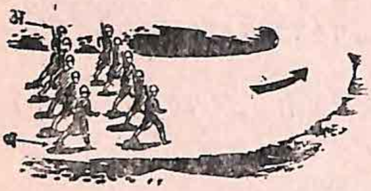
तीनों में से कौनसी एक रस्सी सब से मजबूत सहारा खंभे को देगी ?

आगे के सवाल हल करो।



३३

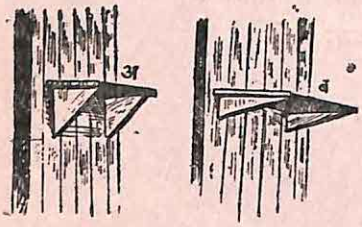
ऊंची नीची ज़मीन पर कौन सी चौकी ठीक से जम कर पायों पर खड़ी रह सकेगी?



३४

सिपाही जब सड़क के साथ घूमेंगे तो कौन से सिपाही को लाइन बनाए रखने के लिए ज्यादा चलना पड़ेगा ?

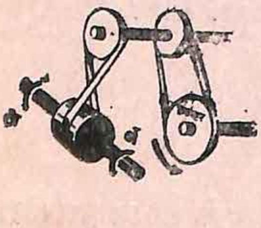
(बराबर हो तो 'क' पर चिन्ह लगाओ)



३५

कौन सा पटिया अधिक बोझ सह सकता है?

(बराबर मजबूत हों तो 'क' पर चिन्ह लगाओ)

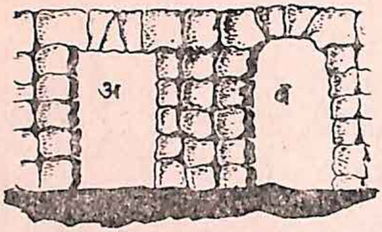


३६

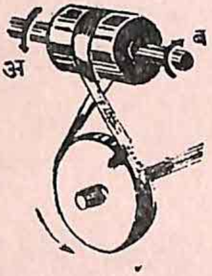
अगर ड्राइवर तीर से बताई दिशा में घूमे तो 'क्ष' धुरी किस दिशा में घूमेगी ?

(किसी भी ओर घूम सके तो 'क' पर चिन्ह लगाओ)

पन्ना उलट कर आगे के सवाल हल करो।

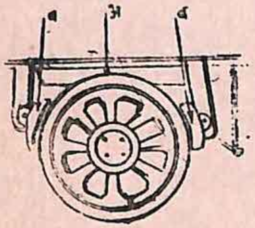


३७
कौन सी मेहराब ज्यादा मज़बूत है ?
(बराबर हो तो 'क' पर चिन्ह लगाओ)



३८
जब नीचे वाला पहिया तीर से बताई दिशा में घुमेगा तो ऊपर की धुरी किस ओर फिरेगी ?

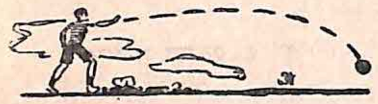
(दोनों में से किसी भी ओर फिर सके तो 'क' पर चिन्ह लगाओ)

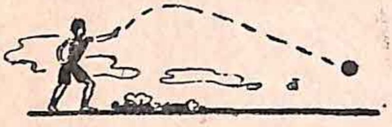


३९
कौन सा हिस्सा अधिक घिसेगा ?

(बराबर घिसें तो 'क' पर चिन्ह लगाओ)

आगे के सवाल हल करो।

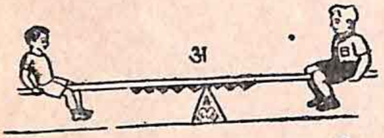


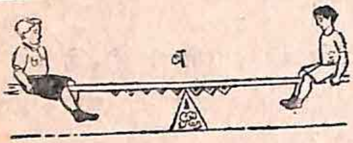


४०

किस चित्र में फेंकी हुई गेंद का मार्ग ठीक दिखाया गया है ?

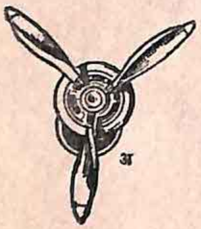
(कोई भी ठीक हो सकती हो तो 'क' पर चिन्ह लगाओ)

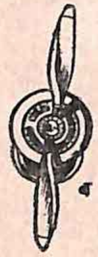




४१

कौन सा पटिया संतुलित रहेगा ?
(दोनों बराबर संतुलित हों तो 'क' पर चिन्ह लगाओ)





४२

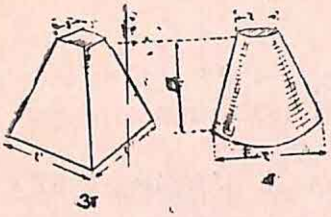
कौन सा पंखा चलाने में ज्यादा शक्ति खर्च होगी ?

(बराबर हो तो 'क' पर चिन्ह लगाओ)

४३

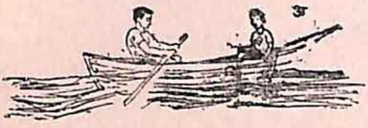
शीशे में घड़ी का आकार कैसा दीखेगा, यह किस चित्र में ठीक दिखाया है ?

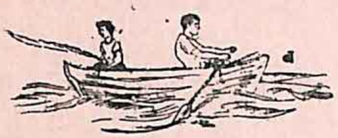
पन्ना उलट कर आगे के सवाल हल करो।



४४

कौन सा कम भारी है ?
(बराबर हो तो 'क' पर चिन्ह लगाओ)

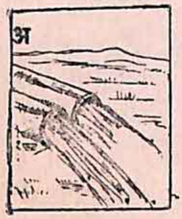


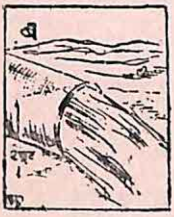


४५

कौन सी नाव ज्यादा आसानी से खेई जा सकती है ?

(बराबर हो तो 'क' पर चिन्ह लगाओ)

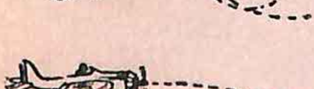


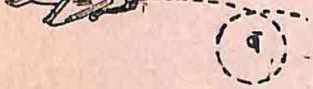


४६

'अ' चित्र के दो और 'ब' चित्र के एक नल के पाइप में किस से ज्यादा पानी निकलेगा ?

(बराबर निकले तो 'क' पर चिन्ह लगाओ)

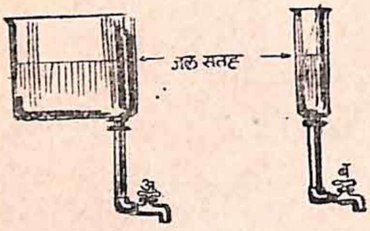




४७

कौनसी चक्करदार डुबकी लगाने में हवाबाज के मशीन से गिर जाने का भय है ?
(बराबर सम्भव हो तो 'क' पर चिन्ह लगाओ)

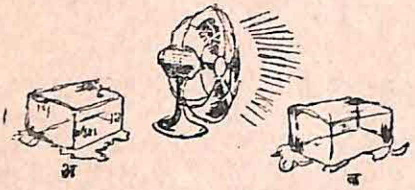
आगे के सवाल हल करो।



४८

किस नल में पानी का दबाव ज्यादा होगा ?

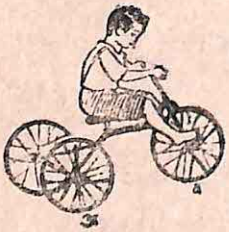
(बराबर हो तो 'क' पर चिन्ह लगाओ)



४९

बरफ का कौनसा टुकड़ा पहले गल जायेगा ?

(बराबर हो तो 'क' पर चिन्ह लगाओ)



५०

अगर बच्चा साइकिल को अपने सीधे हाथ की तरफ घुमाता जाए तो 'अ' और '**ब**' पहियों में से कौनसा कम घूमेगा ?

(बराबर घूमे तो 'क' पर चिन्ह लगाओ)

समाप्त

प्रश्न-पत्रिका

इस पन्ने को मत उलटो और
इस पर कुछ भी मत लिखो

UNIVERSITY TRAINING COLLEGE

TEST VI

नीचे दिए गये संकेतों को ध्यानपूर्वक पढ़ो :—

(१) **प्रश्न-पत्रिका में प्रश्न क्रमपूर्वक दिए गए हैं।** उत्तर-पत्रिका में रिक्त-स्थान भी उसी क्रम से दिए गए हैं। **प्रत्येक प्रश्न का क्रमांक भलीभाँति देखकर, उत्तर पत्रिका में उसी क्रम के रिक्त-स्थान में उस प्रश्न का उत्तर लिखो।**

(२) इस परीक्षा में तेज़ी अथवा कार्य की गति का अत्यन्त महत्व है। एक सरल काम तुम कितनी तेज़ी से कर सकते हो, यही इसी परीक्षा में देखना है। इस परीक्षा के लिए समय तुमको बहुत कम मिलेगा।

(३) **उदाहरण**—अब कुछ उदाहरण देखो :—

नीचे बाईं ओर कुछ अक्षर और संख्याएँ एकत्रित करके दी गई हैं। दाहिनी ओर इन्हीं अक्षरों और संख्याओं को भिन्न-भिन्न क्रमों में छ: जगह लिखा गया है। अक्षरों और संख्याओं के इन छ: समूहों में से जिस समूह का क्रम बाईं ओर दिए गए समूह के समान हैं, उस क्रमांक पर (/) चिन्ह लगाकर उत्तर-पत्रिका में दिखलाना है।

प्राप्तांक	प्रश्न	1	2	3	4	5	6
	१. M2F57	57MF2	572FM	7FM25	F5M27	M2F57	725FM
	२. KOR34	KO3R4	O3RR4	3KR40	KOR34	RKO34	43ORK

उत्तर-पत्रिका में उत्तर देने की विधि :—

उत्तरांक	उत्तर					
१.	१	२	३	४	५	६
२.	१	२	३	४	५	६

प्रथम प्रश्न के सामने दिए गए छः उत्तरों में, पांचवे क्रम के उत्तर में संख्याओं और अक्षरों का वही क्रम है जैसा कि प्रश्न में, इसलिए पांचवें क्रमांक पर (/) चिन्ह बना दिया गया है। इसी प्रकार दूसरे प्रश्न में, चौथे उत्तर में, अक्षरों और संख्याओं का क्रम प्रश्न के सामने होने से चौथे क्रमांक पर (/) चिन्ह लगा दिया गया है।

(४) इस परीक्षा में तुमको यही काम बहुत तेज़ी से करना है। उत्तर-पत्रिका में उत्तर, प्रत्येक प्रश्न के सामने उसी क्रमांक पर होना चाहिए, जिस क्रम के समूह अथवा उत्तर में अक्षरों और संख्याओं का वही क्रम है जैसा कि प्रश्न में। प्रत्येक प्रश्न का एक ही सही उत्तर है इसलिए उत्तर-पत्रिका में किसी भी प्रश्नांक के सामने एक से अधिक (/) चिन्ह लगाने पर उत्तर गलत समझा जायगा।

(४) अब उत्तर-पत्रिका में अपना नाम और कक्षा इत्यादि लिखो।

(५) **अभ्यास** :—नीचे दिए गए चार प्रश्नों के उत्तर, उत्तर-पत्रिका में प्रथम चार अंकों के सामने दी गई रेखाओं के पास, उत्तर का क्रमांक भलीभाँति देखकर दो :—

प्रश्न-पत्रिका पर कुछ भी मत लिखो।

	उत्तर					
92T4P	92T4P	P4T29	492TP	2P4T9	T94P2	PT294
HL5K3	3KL5H	HL5K3	5HKL3	3LKH5	K35HL	H5LK3
2PNCS	PCSN2	NSP2C	2CNSP	SCPN2	N2CPS	2PNCS
3L418	1L394	L4831	3184L	3L418	४413L	L1438

संकेत मिलते ही उत्तर-पत्रिका में अपने उत्तर देना आरम्भ करो। 'समाप्त' की आज्ञा मिलते ही एक दम रुक जाओ और प्रश्न-पत्रिका तथा उत्तर-पत्रिका बन्द कर दो।

जब तक कहा न जाय इस पन्ने को मत उलटो।

		1	2	3	4	5	6
1.	13R7P	17P3R	71RP3	13R7P	1R37P	3P71R	RP731
2.	2N3BC	3B2NC	2N3BC	CB3N2	CB2N3	2NB3C	23CNB
3.	N4P63	NP364	P364N	NP346	N6P43	N4P63	643PN
4.	PQ7D8	DQP78	87PDQ	P78QD	PQD78	DP78Q	PQ7D8
5.	52S9M	59M2S	MS529	295SM	52S9M	9SM25	MS925
6.	DK8H4	DH48K	DK8H4	4HKD8	DKH84	8KHD4	8DH4K
7.	G5C38	G5C38	G38C5	GC358	53CG8	385GC	CG583
8.	NL6G4	GL4N6	NL6G4	NG46L	NLG64	46GLN	64NLG
9.	P3M64	64MP3	PM436	P36M4	P3M64	M63P4	46P3M
10.	4F7TO	4FT7O	7T4FO	47OFT	OTF47	T47OF	4F7TO
11.	R7J32	R723J	3JR72	RJ237	R37J2	J27R3	R7J32
12.	QC2N8	CQN82	QNC28	28CNQ	QC2N8	2QN8C	8NQ2C
13.	D4F75	DE574	D47E5	7D45E	57ED4	E47D5	D4E75
14·	SY5V4	SV54Y	54YSV	SY5V4	4YVS5	S5V4Y	S4VY5
15.	42Z8D	2D84Z	4Z82D	84ZD2	ZD248	42Z8D	D82Z4
16.	JXON1	JNO1X	1ONJX	JXNO1	OXINJ	JXON1	JN1XO
17.	39L1D	39L1D	931DL	D1L93	319DL	L91D3	L1D93
18.	8S3CP	8SCP3	PC3S8	83SCP	8S3CP	C8SP3	3PC8S
19.	N4A52	245AN	NA542	N4A52	NA245	5N42A	25NA4
20.	DEQ27	D27QE	DQE27	7QD E	DEQ27	27EDQ	ED27Q
21.	J83W9	J8W39	JW983	3J89W	W93J8	J83W9	3W8J9
22.	95TRK	95RTK	9RK5T	95TRK	R9TK5	KT95R	9TR5K
23.	PK1O3	PKO31	PK1O3	P13OK	OPK31	O31KP	P1KO3
24.	9BJ7T	9B7JT	97TJB	J97TB	9BJ7T	T7B9J	J7T9B
25.	P97H2	P729H	P9H72	7PH29	H29P7	2H79P	P97H2

अब अगले पन्ने के

		1	2	3	4	5	6
26.	IZB5C	IZ5BC	5CBIZ	CBIZ5	5IZBC	IZB5C	BC5IZ
27.	FCW45	FCW45	45CFW	WFC45	FC4W5	WF4F5C	4WC5F
28.	Z43T9	Z4T39	394ZT	ZT943	TZ394	Z43T9	93T4Z
29.	5NR8H	58HNR	H8R5N	5RN8H	5NR85R	NH8H	R8N5H
30.	Y15X6	16XY5	6XY15	Y51X6	6X51Y	5X61Y	Y15X6
31.	B5TG4	4TBG5	B5GT4	BT45G	B5TG4	G5BT4	G4TB5
32.	7E25K	KE752	75E2K	275KE	2KE75	52KE7	7E25K
33.	NRG75	NRC74	R47CN	NCR74	CN47R	74RNC	7CRN4
34.	81W6F	816WF	6FW81	81W6F	86F1W	W186F	FW861
35.	QD9A5	Q9AD5	QA59D	QD9A5	5AQD9	DQA59	59DAQ
36.	S9M27	S92M7	SM729	27MS9	M9S27	S9M27	72S9M
37.	8SPBH	8PHSB	P8SHB	BPSH8	8SBPH	HPBS8	8SPBH
38.	W9564	W5496	6W945	65W94	W9654	W9564	4569W
39.	9KHST	9STKH	9KHST	HK9ST	HTS9K	TSHK9	K9STH
40.	J6734	J3476	J6734	7J346	3647J	4763J	J6374
41.	5GNBK	5GNBK	B5NKG	5NBGK	5NKGB	KBGN5	GB5NK
42.	D7129	D7921	D7129	2D791	2197D	9127D	17D29
43.	6UIAB	6IBAU	I6UBA	BAUI6	UBAI6	BA6IU	6UIAB
44.	V2637	7623V	V2637	36V27	V2367	V6723	2V276
45.	8YOAQ	8YAOQ	OQY8A	AYS8OQ	80QAY	8YOAQ	AQOY8
46.	M5732	M5732	M3257	5M327	75M32	2375M	27M35
47.	9OUIZ	ZIUO9	O9IZU	9IOUZ	9OUIZ	UI2OZ	ZU9OI
48.	E6917	E9167	176E9	E9761	E6917	61E97	7196E
49.	5OEA5	5OAET	E5ATO	TOEA5	5ETOA	AOTE5	TAEO5
50.	G1986	G8619	1G698	G1986	6991G	9618G	G8168

प्रश्न-पत्रिका इस पन्ने को मत उलटो और इसपर कुछ भी मत लिखो

UNIVERSITY TRAINING COLLEGE
TEST VII

नीचे दिए गये संकेतों को ध्यानपूर्वक पढ़ो :—

(१) इस परीक्षा के उत्तर तुम्हें अंकों के रूप में देना हैं। इन अंकों को स्पष्ट रूप से लिखो। अस्पष्ट अंक अथवा दो प्रकार से पढ़े जाने वाले अंक गलत समझे जायेंगे।

(२) प्रश्न-पत्रिका में प्रत्येक प्रश्न का क्रमांक भलीभाँति देखकर, उत्तर, उत्तर-पत्रिका में उसी क्रमांक के सामने लिखो।

(३) अब, इस परीक्षा में तुम्हें क्या करना है, यह समझ लो।

इस पन्ने के पीछे कुछ शब्द दिए हुए हैं। प्रत्येक शब्द के सामने दाहिनी तरफ एक अंक दिया हुआ है। वह इस शब्द का अंक है। प्रत्येक शब्द का कौन सा अंक है, यह तुम्हें याद करना है। इसके लिए तुमको छः मिनिट का समय दिया जायगा। समय समाप्त होने की सूचना मिलते ही याद करना बन्द कर दो और प्रश्न-पत्रिका परीक्षक को वापस लौटा दो। इसके पश्चात् आज्ञा मिलते ही उत्तर-पत्रिका पर उत्तर लिखना शुरू करो।

(४) अब उत्तर-पत्रिका पर अपना नाम और कक्षा इत्यादि लिखो।

कोई शंका हो तो पूछो

जब तक कहा न जाय इस पन्ने को मत उलटो।

१९ जब मैं पढ़ने बैठता हूँ तो मैं अपने को इतना थका हुआ, ऊबा हुआ या नींद में भरा हुआ पाता हूँ कि ठीक से पढ़ नहीं पाता ।

२० मैं हर उस विषय में जिसे में चुनता हूँ पूरी पूरी रुचि पैदा करने का प्रयत्न करता हूँ ।

२१ कालिज में पढ़ने का गौरव ही विशेष रूप से मुझे कालिज में पढ़ने पर उत्साहित करता है ।

२२ मैं सोचता हूँ कि मुझे पढ़ाई छोड़ कर नौकरी कर लेनी चाहिये ।

२३ जब मुझे कोई विशेष काम करना होता है या किसी परीक्षा के लिए विशेष रूप से तैयारी करनी होती है तो मैं कक्षा में जाना छोड़ देता हूँ ।

२४ मैं अपना बहुत सा समय रिसाले पढ़ने, रेडियो सुनने, सिनेमा जाने, दोस्तों के साथ घूमने आदि में नष्ट कर देता हूँ जिसका प्रभाव मेरी पढ़ाई पर बुरा पड़ता है ।

२५ मेरी पढ़ाई बिना किसी नियम के चलती रहती है । जब कोई क्लास होने वाला हुआ तो पढ़ लेता हूँ वर्ना नहीं ।

२६ मैं स्कूल के खाली घन्टों में अपनी पढ़ाई का काम कर लेता हूँ ताकि शाम को या रात में काम कम करना पड़े ।

२७ मैं अपना लिखने का काम समय पर कर लेता हूँ ।

२८ मुझे पढ़ते समय इस बात के समझने में कठिनाई होती है कि कौन सी चीज ऐसी Important है जो बाद में परीक्षा में भी पूछी जा सकती है ।

२९ मैं जितना समय पढ़ने पर लगाता हूँ उसको देखते हुए मेरी प्राप्त योग्यता बहुत ही कम है ।

३० पढ़ाई के सम्बन्ध में मैं मन मौजी हूँ । मूड आया तो पढ़ लिया वर्ना नहीं ।

३१ पढ़ने पर बैठने से पहले मैं यह निश्चित कर लेता हूँ कि कितना पढ़ना है ।

३२ मैं अपना स्कूल का दिया हुआ काम रोज के रोज पूरा कर लेता हूँ ।

३३ दूसरों के साथ मिल कर पढ़ने की बजाए मैं अपना पाठ अकेले पढ़ना ज्यादा पसन्द करता हूँ ।

३४ जब मैं परीक्षा की तैयारी करता हूँ तो उन चीजों को जो मुझे याद करना होता है एक क्रम से लगा लेता हूँ। जैसे जो ज्यादा Important है उसे पहले जो कम Important है उसे बाद में। जो कक्षा में पहले पढ़ाया गया है उसे पहले जो बाद में पढ़ाया गया है उसे बाद में।

३५ परीक्षा में मैं अन्तिम समय तक लिखता रहता हूँ परन्तु फिर भी मैं नियत समय में काम समाप्त नहीं कर पाता।

३६ जब परीक्षा की कापियाँ या स्कूल का लिखाई का काम मुझे वापस मिलता है तो मुझे पता चलता है कि मुझे ऐसी गलतियों के कारण जो मेरी लापरवाही से हो गई थीं कम नम्बर मिले।

—: :—

१	चित्र	...	१०
२	रेलगाड़ी	..	३५
३	पुस्तक	...	२६
४	दरवाजा	...	४९
५	कबूतर	...	५३
६	यंत्रालय	...	७८
७	अमरूद	...	६१
८	साइकल	...	८४
९	कोयला	...	११
१०	तराजू	...	९५
११	जलयात्रा	...	५७
१२	चौराहा	...	८७
१३	प्रकाश	...	७१
१४	तालाब	...	६७
१५	आकाश	...	४२
१६	चबूतरा	...	१४
१७	डाक घर	...	६३
१८	समाचार	...	३८
१९	बंदर	...	२१
२०	टीला	...	५९
२१	ठंडा	...	५६

प्रश्न-पत्रिका

इस पन्ने को मत उलटो और इसपर कुछ भी मत लिखो

UNIVERSITY TRAINING COLLEGE TEST VIII

नीचे दिए गए आदेशों को ध्यानपूर्वक पढ़ो :—

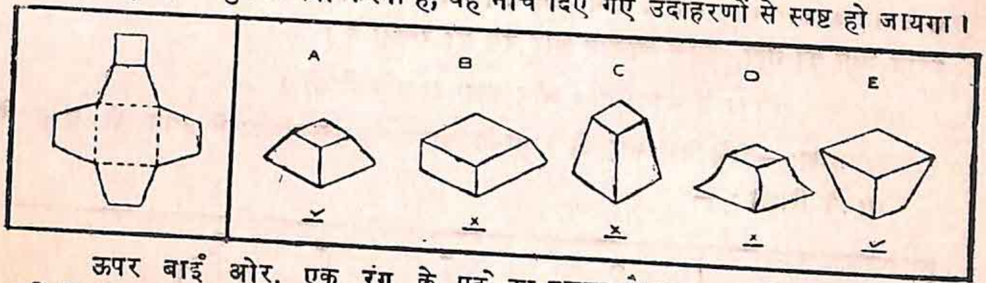
१ प्रश्न-पत्रिका में प्रश्न क्रमपूर्वक दिए गए हैं। उत्तर-पत्रिका में रिक्त स्थान भी उसी क्रम से दिए गए हैं। प्रत्येक प्रश्न का क्रमांक भलीभाँति देखकर, उत्तर-पत्रिका में उसी क्रम के रिक्त-स्थान में उस प्रश्न का उत्तर लिखो।

२ इस परीक्षा के प्रश्नों का उत्तर देने के लिए तुम्हें उत्तर-पत्रिका में दी गई छोटी रेखाओं पर (×) क्रॉस अथवा (✓) टिक-इन दो चिन्हों में से एक चिन्ह बनाना है। यह चिन्ह बिल्कुल स्पष्ट होना चाहिए। अगर कोई लगाया हुआ चिन्ह तुम्हें गलत मालूम पड़े तो उसे स्पष्ट रूप से काटकर, उसके ऊपर सही चिन्ह बनाओ। एक ही रेखा पर दो चिन्ह लगे रहने से उत्तर गलत समझा जायगा।

३ प्रश्न-पत्रिका अथवा उत्तर-पत्रिका पर किसी भी प्रकार के चित्र अथवा रेखाएँ मत खींचो। अच्छी तरह सोचने के पश्चात् उत्तर दो।

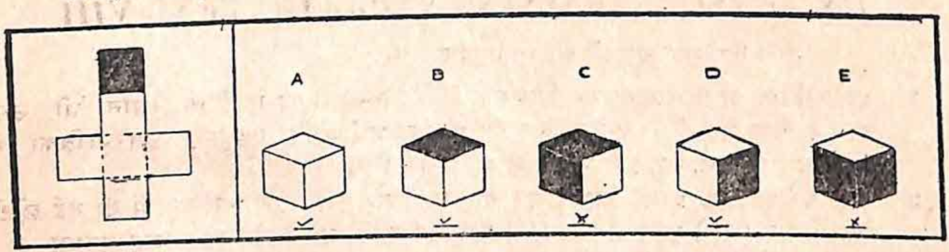
४ यह परीक्षा कुछ नए प्रकार की है। इसमें दो रंग के पुठ्ठों के टुकड़े चित्र के रूप में दिखलाए गए हैं। पुठ्ठों के इन टुकड़ों को दिखलाई गई रेखाओं पर से मोड़ने पर डिब्बे तय्यार होते हैं और भिन्न भिन्न दिशाओं से देखने पर इन डिब्बों का रूप व आकार कैसा दिखेगा, इसका निर्णय तुम्हें करना है। उत्तर के स्थान में रेखाओं के ऊपर A, B, C, D, E नामक भिन्न भिन्न आकार के डिब्बों के पाँच चित्र तुम्हें दिए गए हैं। तुम्हें यह बतलाना है कि दिए गए पुठ्ठों के टुकड़ों से, इन पाँच डिब्बों में से कौनसे डिब्बे बन सकते हैं और कौन से नहीं। टुकड़ों पर दिखलाए गए रंग, उन टुकड़ों के एक ही ओर न होकर दोनों ओर है।

५ **उदाहरणः**—तुमको क्या करना है, यह नीचे दिए गए उदाहरणों से स्पष्ट हो जायगा।



ऊपर बाईं ओर, एक रंग के पुठ्ठे का टुकड़ा फैलाया हुआ दिखलाया गया है। दाहिनी ओर पांच डिब्बों के आकार दिखलाए गए हैं। प्रत्येक डिब्बे के नीचे एक छोटी सी रेखा उत्तर देने के लिए बनादी गई है। यदि पाँच डिब्बों में से कोई डिब्बा, दिए गए पुठ्ठे के टुकड़े से बन सकता है तो रेखा पर (✓) टिक चिन्ह लगाना है। अगर नहीं बन सकता है तो रेखा पर (×) क्रॉस चिन्ह लगाना है। पहला डिब्बा बन सकता है इसलिए उसके नीचे की रेखा पर (✓) चिन्ह बना दिया गया है। दूसरा डिब्बा नहीं बन सकता क्योंकि दिए गए पुठ्ठे टुकड़े के चारों बाजू समान हैं लेकिन इस डिब्बे के नहीं। इसलिए इस डिब्बे के नीचे की रेखा पर (×) क्रॉस चिन्ह लगा दिया गया है। तीसरा डिब्बा बहुत ऊँचा है, इसलिए यह भी नहीं बन सकता। इसके उत्तर में भी, इसलिए (×) चिन्ह लगा दिया गया है। चौथा डिब्बा भी नहीं बन सकता क्योंकि इसके बाजू दिए गए पुठ्ठे के टुकड़े बाजूओं की तरह सीधे न होकर, टेढे हैं। इसके उत्तर में भी, इसलिए (×) चिन्ह लगा दिया गया है। पाँचवां डिब्बा बन सकता है। इसमें और पहले डिब्बे में सिर्फ यही अन्तर है कि पहला डिब्बा उलटा कर के रखा गया है और यह सीधा करके। आकार में दोनों के कोई भेद नहीं है। इसलिए इसका उत्तर भी (✓) चिन्ह से दिया गया है।

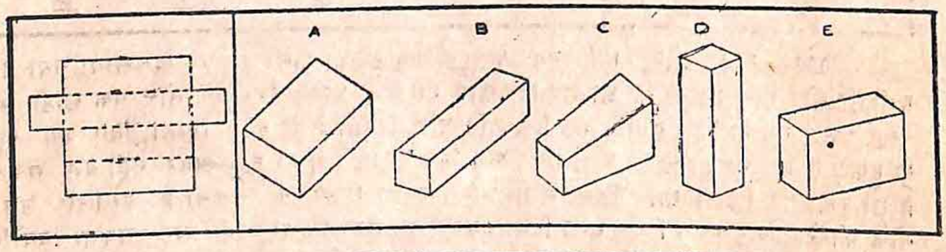
अब इस उदाहरण को देखो :—

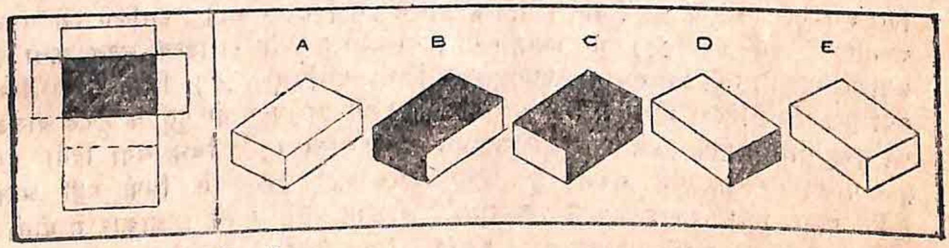


इस टुकड़े में दो रंग हैं । पहले और दूसरे डिब्बे बन सकते हैं इसलिए दोनों के उत्तर में (✓) चिन्ह लगा दिया गया है । तीसरे डिब्बे के दो भाग रंगीन होने के कारण यह गलत है क्योंकि दिए गए पुठ्ठे के टुकड़े का केवल एक ही भाग रंगीन है । इसलिए उसके नीचे (×) चिन्ह लगा दिया गया है । चौथा डिब्बा ठीक है इसलिए उसके नीचे (✓) लगा दिया गया है । पांचवा डिब्बा फिर गलत है क्योंकि तीसरे डिब्बे की तरह इसके भी दो भाग रंगीन हैं । इसलिए इसका उत्तर भी (×) चिन्ह बनाकर दिया गया है । इस उदाहरण में एक बात यह ध्यान देने की है कि इसमें दिए गए पुठ्ठे के टुकड़े और उससे तय्यार हो सकने वाले डिब्बों के माप में अन्तर है । बने हुए डिब्बे पुठ्ठे के टुकड़े से तय्यार होने वाले डिब्बे से बड़े दीखते हैं । किन्तु इस परीक्षा में छोटे बड़े का प्रश्न नहीं है । तुमको सिर्फ यही देखना है कि दिए गए पुठ्ठे के टुकड़े के आकार और रंग को ध्यान में रखते हुए, उसी अथवा उससे छोटे बड़े आकार और रंग के कौन कौन से डिब्बे तय्यार हो सकते हैं और कौन नहीं । ध्यान माप का नहीं, केवल आकार और रंग का रखना है ।

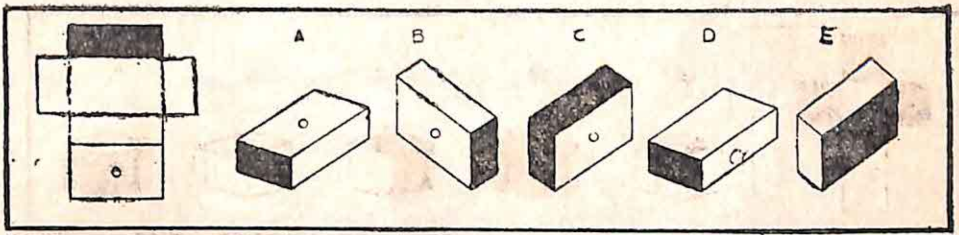
अब उत्तर-पत्रिका में अपना नाम और कक्षा इत्यादि लिखो ।

६ **अभ्यास**:—नीचे दिए गए दो प्रश्नों के उत्तर, उत्तर-पत्रिका में प्रथम दो अंकों के सामने लिखो :—





कोई शंका हो तो पूछो ।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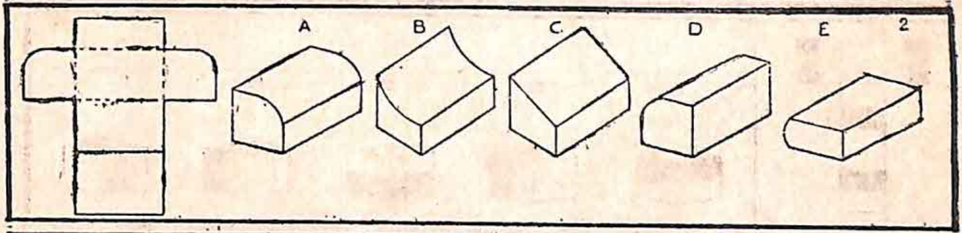
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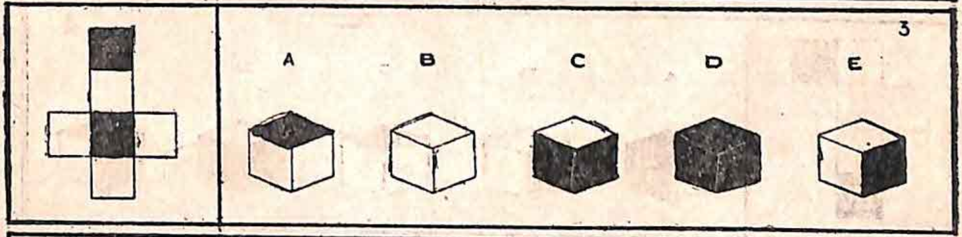
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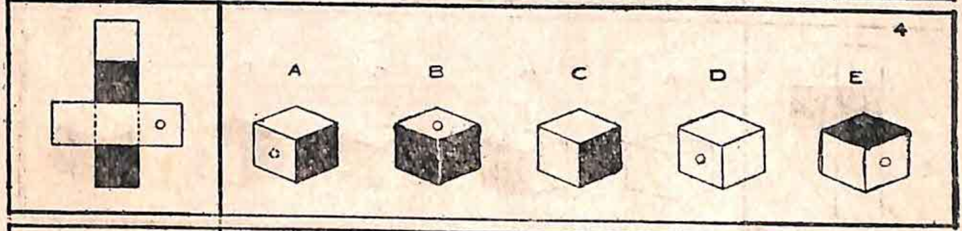
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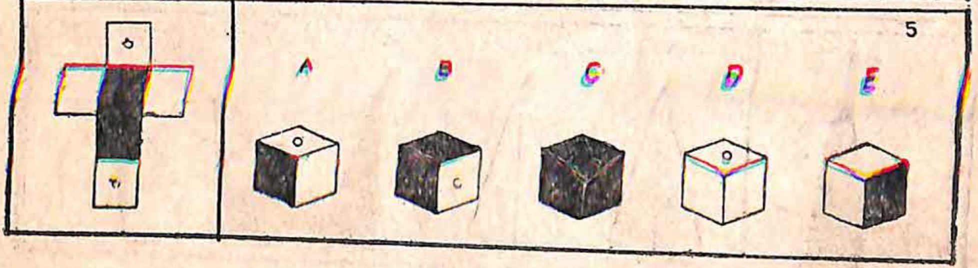
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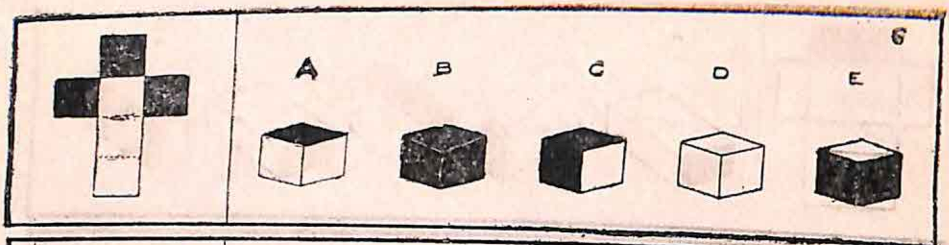
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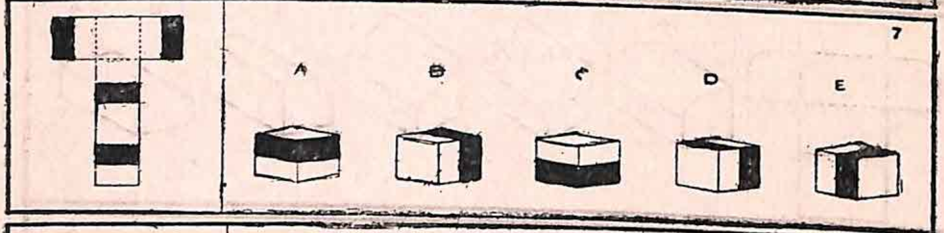
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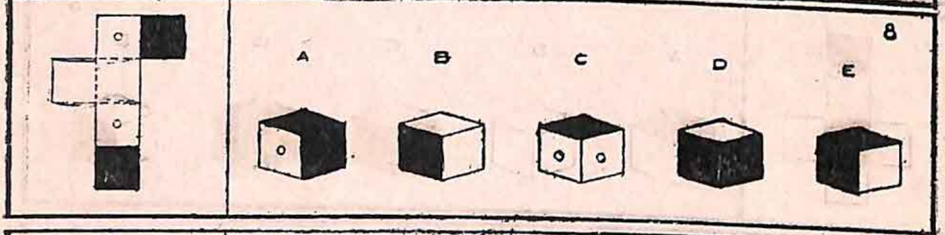
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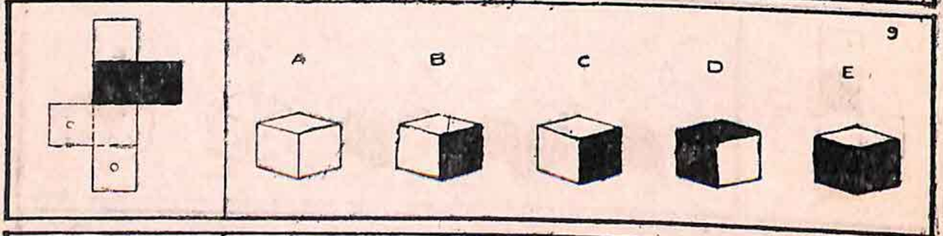
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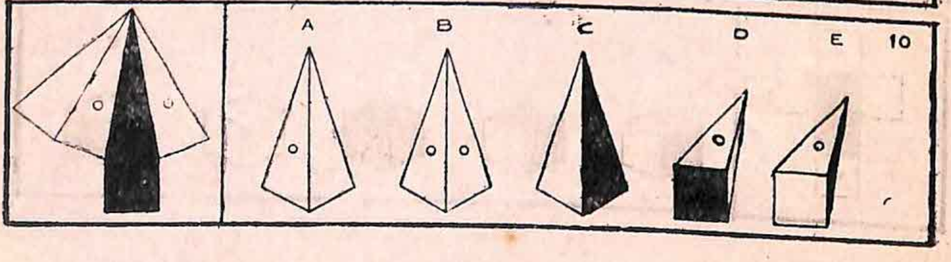
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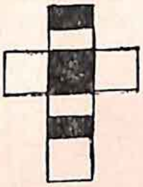

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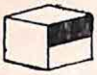

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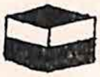

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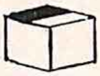

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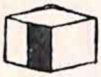

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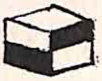

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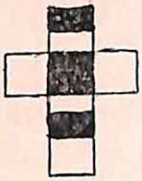

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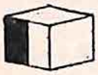

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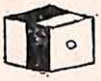

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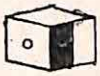

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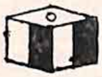

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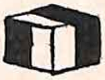

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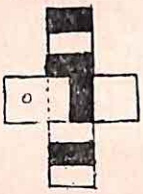

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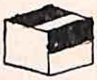

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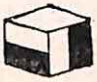

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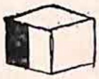

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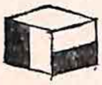

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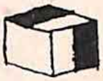

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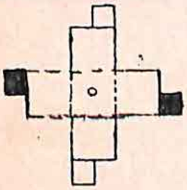

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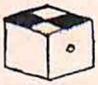

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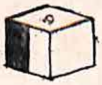

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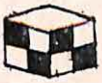

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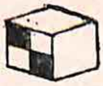

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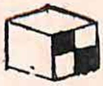

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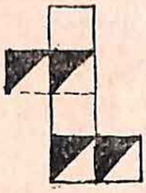

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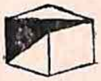

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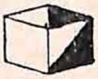

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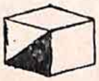

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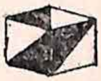

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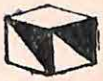

Brown-Holtzman Survey of Study Habits and Attitudes (Male)

सामान्य निर्देश

इस जांच का उद्देश्य आपकी अपनी पढ़ाई के नियमों तथा उससे सम्बन्धित विचारों से जानकारी प्राप्त कराना है, ताकि आप स्वयं उनमें आवश्यकतानुसार परिवर्तन करके अपनी पढ़ाई में उन्नति कर सकें । यदि आप इस पर गम्भीरता पूर्वक विचार करेंगे तो आपको इस विषय में कि अच्छी प्रकार किस तरह पढ़ा जाये, बहुत जानकारी प्राप्त हो सकती है । यदि आप ईमानदारी से उन बातों का जो आगे के पृष्ठों में दी गई हैं, उत्तर देंगे तो आपको अपने पढ़ाई के नियमों की बहुत सी त्रुटियों के बारे में भी जानकारी प्राप्त हो सकती है । आपको इस जांच से उसी मात्रा में लाभ होगा जिस मात्रा में लाभ होगा जिस मात्रा में आप अपने उत्तरों को ध्यानपूर्वक देने का प्रयत्न करेंगे । चूंकि आपके उत्तर किसी को बताये जाने के लिये नहीं हैं, इसलिये आप बिना किसी दुविधा के सारे प्रश्नों का ठीक ठीक उत्तर दें ।

उत्तर देने के लिये आपको एक अलग उत्तर पत्रिका दी गई है । सारे उत्तर उसी पर लिखने हैं । इस कापी पर किसी प्रकार का चिन्ह नहीं लगाना है ।

इस प्रश्न-पत्र में ३६ प्रश्न हैं । उत्तर-पत्रिका में हर प्रश्न का उत्तर देने के लिए पांच खाने बने हैं । हर प्रश्न को पढ़ने के बाद आपको यह सोचना है कि जो बात कही गई वह आप पर किस मात्रा में लागू होती है— 'बहुत ही कम', 'कभी-कभी', 'कई बार', 'बहुत बार', या 'करीब करीब हमेशा' ।

जब आप अपने मन में कोई निर्णय करलें तो उचित खाने में जो ऊपर दिये पांच प्रकार के निर्णयों को दर्शाने के लिये बताये गये हैं, एक ठीक (✓) का चिन्ह लगा दें ।

उदाहरण के लिये यदि इस बात के विषय में कि "मुझे कक्षा के अध्यापक से प्रश्न पूछते हुए हिचकचाहट मालूम होती है" आपके अपने बारे में ठीक-ठीक विचार यह है कि ऐसा "बहुत ही कम" होता है तो पहले खाने में ठीक का चिन्ह (✓) लगा दें । यदि "कभी-कभी" ऐसा होता है तो दूसरे खाने में, यदि "कई बार" ऐसा होता है तो तीसरे खाने में, यदि "बहुत बार" ऐसा होता है तो चौथे खाने में और यदि "करीब करीब हमेशा" ऐसा होता हो पांचवे खाने में चिन्ह लगावें ।

नीचे दिये गये संकेतों से आपको अपने उत्तर देने में सहायता मिलेगी:—

"बहुत ही कम"—यदि ० (शून्य) से १५ प्रतिशत बार ऐसा होता हो ।

"कभी-कभी"—यदि १६ से ३५ प्रतिशत बार ऐसा होता हो ।

भाग ४—शिक्षाप्रद चित्रपटों की सूची ।

यदि आपको इन चित्रपटों को देखने का अवसर प्रदान किया जाये तो अपनी रुचि बताइये ।

क्रम	शिक्षाप्रद चित्रपटों की सूची	रुचि है	न तो रुचि है न अरुचि	अरुचि है
१	जापान में चावल की खेती	....	....	....
२	विज्ञान के चमत्कार	....	....	....
३	फसल को कीड़े से बचाना	....	....	....
४	भिन्न भिन्न देशों में सिचाई	....	....	....
५	एक वैज्ञानिक का जीवन	....	....	....

भाग ५—वस्तुओं की सूची ।

यदि इन वस्तुओं को अपनाना हो तो अपनी रुचि प्रकट कीजिये ।

१	औजारों का डिब्बा	....	....	....
२	फुटबाल	....	....	....
३	सूक्ष्म वाक्षण यंत्र (Microscope)	....	....	....
४	चित्रकारी का सामान	....	....	....
५	लेथ मशीन	....	....	....
६	बिजली की घंटी	....	....	....
७	खेती के औजार	....	....	....

भाग ६—पुस्तकों की सूची ।

यदि इन पुस्तकों को पढ़ने की बात हो तो अपनी रुची प्रकट कीजिये ।

१	विज्ञान के चमत्कार	....	....	....
२	देशी और विदेशी खेल	....	....	....
३	कवितावली	....	....	....
४	व्यायाम और शारीरिक विकास	....	....	....
५	खिलाड़ी पथ प्रदर्शन	....	....	....
६	मेरी विदेश यात्रा	....	....	....
७	अच्छी फसल कैसे पैदा की जाये	....	....	....
८	शीघ्रलेखन सीखिये	....	....	....
९	नागरिक जीवन और उसकी समस्याएँ	....	....	....

"कई बार"—यदि ३६ से ६५ प्रतिशत बार ऐसा होता हो।
"बहुत बार" यदि ६६ से ८५ प्रतिशत बार ऐसा होता हो।
"करीब करीब हमेशा" यदि ८६ से १०० प्रतिशत बार ऐसा होता हो।

याद रखिये आपको अपने बारे में इस आधार पर मत नहीं प्रदान करना है कि यह बात मुझे किस प्रकार करनी चाहिये या मुझे इस विषय में कैसा होना चाहिए। न इस आधार पर कि दूसरे इसे किस प्रकार करते होंगे या दूसरे इस बात के विषय में क्या सोचते होंगे बल्कि स्वयं मैं अपनी आदत के अनुसार इस बात को कैसे करता हूँ और किस प्रकार इस विषय में सोचता हूँ।

यदि किसी प्रश्न के विषय में आप स्वयं कोई अनुभव न हो तो आप अलग उत्तार इस प्रकार सोच कर दे कि यदि ऐसा होता तो मैं क्या करता या किस प्रकार इस विषय में सोचता।

किसी प्रश्न का कोई ठीक या गलत उत्तार नहीं है और न इस प्रश्न पत्र को करने के लिये कोई नियत समय है। परन्तु आप जितनी शीघ्रता से इसे कर सकें कीजिये। किसी प्रश्न पर अधिक समय न लगाइये। साथ ही साथ इस बात का भी ध्यान रखिये कि हर प्रश्न का उत्तार ईमानदारी से देना है। क्योंकि ऐसा करने ही से हम आपकी कुछ सहायता कर सकेंगे।

कोई प्रश्न छोड़िये नहीं।

प्रश्नांक :

१ चाहे मुझे कोई विषय पसन्द हो या न हो मैं अच्छे नम्बर लाने के लिए मेहनत से ही काम करता हूँ।

२ जब Home work (अध्यापक का घर पर याद करने के लिये दिया हुआ काम) ज्यादा लम्बा या जरा ज्यादा कठिन होता है तो मैं हिम्मत हार देता हूँ और या तो तंग आकर उसे छोड़ देता हूँ या जल्दी जल्दी छोड़े छोड़ कर पाठ का आसान भाग पढ़ डालता हूँ।

३ अपने विचारों की लिखाई द्वारा प्रकट करने में जो कठिनाई मुझे होती है उसके कारण मे अपना लिखने वाला काम बहुत धीरे धीरे कर पाता हूं।

४ मेरे अध्यापक मेरे लिखे हुए काम पर यह आलोचना करते हैं कि बड़ी जल्दी में या बिना ठीक से सोचे हुये किया गया है।

५ मैं ग्रामर के नियम, मुख्य मुख्य शब्दों की परिभाषाएं अथवा फार्मूले वास्तव में बिना पूरी तरह समझे हुए रट डालता हूँ।

६ यदि अध्यापक का दिया हुआ कोई काम पूरी तरह मेरी समझ में नहीं आता तो मुझे उसे दोबारा पूछते हुए हिचकिचाहट मालूम होती है।

७ स्कूल के कार्यों में रुचि न होने के कारण मैं पढ़ने के लिये दिये गये काम पर अपना ध्यान नहीं लगा पाता।

८ जब तक कि मुझे वास्तव में कोई विषय अच्छा न मालूम हो मैं बस पास होने भर की मेहनत में विश्वास रखता हूं।

९ परीक्षा के समय मैं बहुत घबरा जाता हूं और मेरे सारे विचार डगमग हो जाते हैं इसलिये प्रश्न के उत्तर अपनी योग्यतानुसार नहीं दे पाता।

१० मुझे हिन्दी वाक्यों को शुद्ध रूप से लिखने में कठिनाई मालूम होती है।

११ यदि मैं स्कूल के काम में कभी कभी मजबूरी के कारण पिछड़ जाता हूँ तो मैं बिना अध्यापक के कहे हुए ही अपना पिछला काम पूरा कर डालता हूँ।

१२ मेरे कुछ विषय इतने अरुचिकार हैं कि मुझे अपने ऊपर जोर डाल कर उन्हें पढ़ना पड़ता है।

१३ जब मैं पढ़ रहा होता हूँ तब इधर उधर के विचार जैसे दोस्तों से मिलना है, भविष्य में मुझे यह बनना है, आदि आ आ कर मेरा ध्यान पढ़ाई की ओर से हटा देते हैं।

१४ मैं समझता हूँ कि समय को खेल, कूद, हँसी मज़ाक में गुजारना और जीवन से पूरा पूरा मज़ा उठाना उतना ही महत्वपूर्ण है जितना पढ़ना।

१५ मेरा विचार है कि परीक्षा में जो नम्बर मुझे मिलते हैं मेरी योग्यता को करीब करीब ठीक ही प्रकट करते हैं।

१६ थोड़े से समय में अपने विचारों को एक क्रम से और ठीक ठीक प्रकट करने में मुझे जो कठिनाई होती है उसी कारण मैं परीक्षा में अच्छा नहीं कर पाता।

१७ मैं परीक्षा की कापियों या दूसरे लिखाई के काम जिन्हें अध्यापक ठीक करके वापस करते हैं अलग डाल देता हूँ और उन गलतियों को जो अध्यापक उस में नोट कर देते हैं ठीक करने की चिन्ता नहीं करता।

१८ मैं ध्यान पूर्वक नहीं पढ़ पाता इसलिये कि जब पढ़ने बैठता हूँ तो कभी अजीब सी बेचैनी रहती है। कभी मूड (Mood) नहीं बनता और कभी इधर उधर की बातों का ध्यान आता है।

Interest Inventory (Science Group)

रुचि मापक प्रश्न-पत्र

इन्हें भरो।

नाम...................................कक्षा..........सेक्शन..........रोल नं० ....

स्कूल का नाम...................................विषय ग्रुप.....................

जन्म तिथि...................................आयु..........

आज की तारीख

सामान्य निर्देश—इस परीक्षा का उद्देश्य केवल आपकी रुचियों को जानना है ताकि विषय एवं व्यवसाय के चुनाव में आपकी सहायता की जा सके। योग्यता की परीक्षा से इसका कोई सम्बन्ध नहीं है। आप प्रत्येक **Item** (पद) का उत्तर ईमानदारी से दें। इस परीक्षा पत्र में दी गई सूची में ६ भिन्न प्रकार की चीजों या कार्यों के नाम दिये गये हैं। प्रत्येक **Item** के लिये उचित खाने में ठीक का चिन्ह (√) लगाकर आप उनके विषय में अपनी रुचि बता सकते हैं। यदि किसी के लिये आपकी रुचि है तो पहले खाने में यदि न तो रुचि है और न अरुचि तो दूसरे खाने में और यदि अरुचि है तो तीसरे खाने में ठीक (√) का चिन्ह लगायें।

प्रत्येक **Item** (पद) के बारे में मत दर्शाना आवश्यक है। कोई (**Item**) पद खाली नहीं छोड़ना है।

जब तक आप पूरी सचाई से अपना मत नहीं देंगे तब तक हमारे लिये आपकी शैक्षिक या व्यवसायिक सहायता करना असम्भव होगा। अतः ईमानदारी से अपना मत दीजिये।

भाग १—व्यवसायों की सूची

क्रम	व्यवसाओं की सूची	रुचि है	न तो रुचि है और न तो अरुचि	अरुचि है
१	यन्त्री (इंजीनियर)	....	....	....
२	लेखा परीक्षक (आडिटर)	....	....	....
३	ग्राम सेवक	....	....	....
४	यांत्रिक (मेकैनिक)	....	....	....
५	व्यायाम शिक्षक	....	....	....
६	किसान (कृषक)	....	....	....
७	दलाल	....	....	....
८	मान चित्रकार (ड्राफ्टस्मैन)	....	....	....
९	दुकानदार	....	....	....
१०	पुलिस कांस्टेबल	....	....	....
११	कृषि अधिकारी	....	....	....
१२	कृषि शिक्षक	....	....	....
१३	कारखाने का मजदूर	....	....	....
१४	नगर सैनिक (होम गार्ड)	....	....	....
१५	कृषि विकास अधिकारी	....	....	....
१६	प्रयोग शाला सहायक	....	....	....
१७	कृषि सिंचाई अधिकारी	....	....	....
१८	चित्रकला शिक्षक	....	....	....
१९	खजांची	....	....	....
२०	दर्जी	....	....	....
२१	कृषि सहायक	....	....	....

भाग २—विषयों की सूची

क्रम	विषयों की सूची	रुचि है	न रुचि है न अरुचि	अरुचि है
१	बीजगणित	—....	—....	—....
२	भौतिक शास्त्र	—....	—....	—....
३	रसायन शास्त्र	—....	—....	—....
४	बनस्पति शास्त्र	—....	—....	—....

क्रम	विषयों की सूची	रुचि है	न तो रुचि है न अरुचि	अरुचि है
५	प्राणी शास्त्र	....	....	....
६	खेती	....	....	....
७	शरीर शास्त्र	....	....	....
८	बागबानी	....	....	....
९	अर्थशास्त्र	....	....	....
१०	आरोग्य शास्त्र	....	....	....
११	नागरिक शास्त्र	....	....	....
१२	धातु काम	....	....	....
१३	राज्य शासन	....	....	....
१४	वाणिज्य शास्त्र	....	....	....
१५	कर्मशाला अभ्यास (Workshop Practice)	....	....	....
१६	इतिहास	....	....	....
१७	रंगीत चित्रकारी (Painting)	....	....	....
१८	शीघ्रलेखक एवं टाइपिंग	....	....	....
१९	भूगोल	....	....	....

भाग ३—अवकाश के समय किये जाने वाले कार्यों की सूची।

क्रम	अवकाश के समय किये जाने वाले कार्यों की सूची	रुचि है	न तो रुचि है न अरुचि	अरुचि है
१	बगीचा लगाना	....	....	....
२	चित्रकारी करना	....	....	....
३	कारखाने देखना	....	....	....
४	प्रयोगशाला में प्रयोग करना	....	....	....
५	औजारों के काम करना	....	....	....
६	खेत में काम करना	....	....	....
७	भूगोल समिति में भाग लेना	....	....	....
८	विज्ञान समिति में भाग लेना	....	....	....
९	खेल में भाग लेना	....	....	....
१०	रसायनिक पदार्थ बनाना	....	....	....
११	वैज्ञानिक विकास के सम्बन्ध में पढ़ना	....	....	....